DCS800

Selection, Installation and Start-Up Manual for Rebuild Kits DCS800 Drives

DCS800 Single Drive Manuals

All the documents available for the drive system DCS800 are listed below:

		Language					
	Public. number	E	D	I	ES	F	CN
DCS800 Quick Guide	3ADW000191	x	p	p	p	p	
DCS800 Tools & Documentation CD	3ADW000211	x					
DCS800 Converter module							
Flyer DCS800	3ADW000190	x	x	p	x	p	p
Technical Catalogue DCS800	3ADW000192	x	x	x	x	p	x
Hardware Manual DCS800	3ADW000194	x	x	p	p	p	p
Firmware Manual DCS800	3ADW000193	x	p	p	p	p	p
Installation according to EMC	3ADW000032	x					
Technical Guide	3ADW000163	x					
Service Manual DCS800	3ADW000195	x	p				
Planning and Start-up for12-Pulse converters	3ADW000196	p					
CMA-2 Board	3ADW000136	p					
Flyer Hard - Parallel	3ADW000153	p					
Drive Tools							
DriveWindow 2.x - User's Manual	3BFE64560981	x					
DriveOPC 2.x - User's Manual	3BFE00073846	x					
Optical DDCS Communication Link	3AFE63988235	x					
DDCS Branching Units - User´s Manual	3BFE64285513	x					
DCS800 Applications							
PLC Programming with CoDeSys	CoDeSys_V23	x	x			x	
61131 DCS800 target +tool description - Application Program	3ADW000199	x					
Winding with the DCS 800XXXXX	3ADW000058						
Winder application description							
Flyer magnetic application							
Magnetic application description							
DCS800-E Panel Solution							
Flyer DCS800-E Panel solution	3ADW000210	x					
Hardware Manual DCS800-E	3ADW000224	x					
DCS800-A Enclosed Converters							
Flyer DCS800-A	3ADW000213	x					
System description DCS800-A	3ADW000198	p	p				
Installation of DCS800-A	3ADW000091	p	p				
DCS800-R Rebuild System							
Flyer DCS800-R	3ADW000007	p	p				
DCS800-R Manual	3ADW000197	p					
DCS500/DCS600 upgrade manual							
Extension Modules							
RAIO-01 Analogue IO Extension	3AFE64484567	x					
RDIO-01 Digital IO Extension	3AFE64485733	x					
AIMA R-slot extension	3AFE64661442	x					
Serial Communication							
Drive specific serial communication							
NETA Remote diagnostic interface	3AFE64605062	x					
Fieldbus Adapter with DC Drives RPBA- (PROFIBUS)	3AFE64504215	x					
Fieldbus Adapter with DC Drives RCAN-02 (CANopen)							
Fieldbus Adapter with DC Drives RCNA-01 (ControlNet)	3AFE64506005	x					
Fieldbus Adapter with DC Drives RDNA- (DeviceNet)	3AFE64504223	x					
Fieldbus Adapter with DC Drives RMBA (MODBUS)	3AFE64498851	x					
Fieldbus Adapter with DC Drives RETA (Ethernet)	3AFE64539736	x					
x -> existing p -> planned							
Status 01.2007							

DCS800 Drives

DCS800-R0x

Selection, Installation and Start-Up Manual for Rebuild Kits

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Introduction

How to use this manual

The purpose of this manual is to provide you with the information necessary to select the right rebuild kit with all the necessary or available options, to install it, do the start-up and operate it as a DC drive system. Depending on the kit's configuration, different functionality and different options concerning the user interface are available. As long as the hardware needs to be named or cross-referenced to in a very general way, the term *Rebuild kit* will be used.

Contents of this manual

Introduction describes how to use this manual and the boundary conditions applying.
Basic Selection provides the information about the types of the Rebuild kits, their type designations and options.

Hardware description provides the information about the boards and components

Interfacing the Electronics and Thyristors provides the information about the configurations and functions of drives and examples of the whole circuit diagram.

Installation provides the information about required ambient conditions, space requirements, cabling and wiring and how to install a rebuild system.

Start-up gives some general guidelines and cross references how to commission and start up a DC drive system using a Rebuild kit.

Associated publications

Associated publications see inner page of the jacket of that manual.

Basic Selection

Technical preconditions and limits

If an electrical drive is in operation for several years, most often discussions will be started about items like:

- better factory automation based on latest technology
- decrease of standstill time of production
- availability of spare parts
- increase of productivity; perhaps an enlargement of the whole installation using both types of drives, DC and AC drives
- and other arguments

These wishes can be turned into real life by:

- upgrading the drive itself completely
- upgrading only the converter, which had controlled the DC motor
- upgrading the converter´s electronics only
- upgrading a part of the converter´s electronics.

For a final solution, all the **benefits** described by:

• higher production • more accurate control
• design of state of the art • others

will be compared with the **disadvantages** of revamping described by:

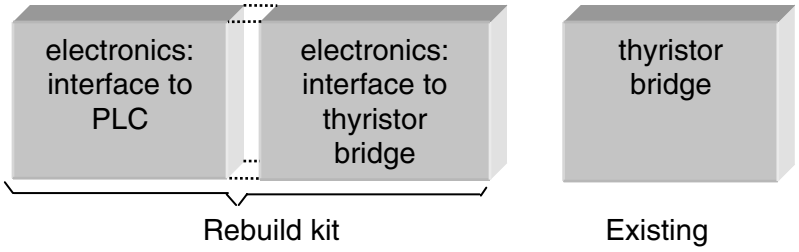
• standstill time of production • hardware cost • training etc.

If this comparison is based on an upgrade of the converter´s electronics the Rebuild kit, which is described within this document, may be a solution. Before the final decision is made to use a Rebuild kit, the configuration of the existing drive needs to be checked more in detail to make sure the kit fulfills all demands.

Selecting the suitable Rebuild kit

The basic structure of a converter to control a DC motor looks like this:

The electronics of the existing converter indicated by the left box above is splitted into 2 boxes in the kit.



The Rebuild kit can be used for armature bridges in non-regenerative or regenera-

tive mode with maximum 4 thyristors in parallel. In case there are more than 4 thyristors in parallel per current direction there is no standard kit prepared; please contact your local ABB organization.

To selecting the Rebuild kit, first the *HARDWARE CONDITIONS* must be checked to become aware of critical limitations. If this is not a problem the *DRIVE´S DESIGN CONDITIONS* will give some guidelines for the overall design. After that a decision must be made for the functionality of the interface between the kit and the Programmable Logic Controller. Depending on that, the Rebuild kit´s type code can be fixed by using the type designations listed on the next pages. Afterwards please check if all conditions are fulfilled as listed in *CONDITIONS CAUSED BY THE APPLICATION*.

Hardware conditions

If a Rebuild kit is taken into consideration, the items listed afterwards will give some help to decide whether a Rebuild kit or a converter module / enclosed converter is the better solution.

- Before an existing DC power part is upgraded by the Rebuild kit, it should be checked if a brand new module may be easier to install or may be a more reliable solution (tested power stack).
- The existing power bridge should be build up by max. 4 thyristors in parallel per current direction (solution for more thyristors in parallel on request). It doesn't matter whether the bridges have the same number of thyristors in parallel.
- The supply voltage used for the existing thyristor bridge has to be lower than 990 V because of the devices used to interface the electronics to the thyristors (higher mains voltages on request).
- The thyristors actually used should be of a disk type. One single thyristor bridge should be capable of running around 1000 A or more, if the converter is built up by more than one bridge in parallel. If a single bridge cannot give this current a brand new converter is probably the more economical solution.
- The ratio between reverse / forward blocking voltage of the thyristors and the nominal line voltage should be factor 3 or higher the blocking voltage has to be measured on a thyristor test stand if the actual blocking voltage gives a lower ratio the thyristor(s) need to be replaced. In such a case, please check if a complete new converter may be more economical.

Drive´s design conditions

It is intended to install the kit into the existing drive cabinet. The following drive equipment will be reused and should therefore be in good condition:

- Check all parts in the AC supply like main disconnecting switch with fuses or main contactor or similar for good condition.
- Check the thyristor bridge itself (fixing devices, press clamps for thyristor mounting, etc.) with cooling equipment for good condition.
- If a Rebuild kit is used for the armature supply the existing field supply can be reused or upgraded too.
  - If the field supply will be upgraded one of these can be used:

SDCS-FEX-425-internal	(built in; 1 or 3 phase)
DCF803-0035	(external; 1 or 3 phase)
DCF803-0050 / ...4-0050	(external; 1 phase)
DCS800-S0x-xxxx-05	(external; 3 phase)

  - If the old field supply will be reused check the overall strategy concerning monitoring, fault tracing and overall control and performance of the drive. Either a binary or an analogue signal should be available indicating “field supply equipment o.k.”. In case this signal is not available galvanic isolated then it should be made potentially free for safety reasons. If the drive should also be used in the field weakening range, an analogue signal, representing the actual field current, is highly recommended. It will be used for monitoring and fault indications generated within the Rebuild kit´s software.
- Depending on the old control structure an analogue tacho generator can be reused. A pulse generator can only be (re)used if it generates a pulse train as an output signal (see *Hardware Manual*).
- The Rebuild kit expects an armature current feedback signal for the current control loop. This signal normally is taken from two current transformers on the a.c. side of the thyristor bridge. The current transformers shall give 0.5 - 0.85 A, which corresponds to the nominal current of the thyristor bridge (other solutions on request).
- A 115V or 230 V AC supply for the Rebuild kit´s electronics is needed.

Conditions caused by the application

It has to be checked if the selected Rebuild kit type can handle the application of the existing drive. As long as the existing one was used in a 6 pulse bridge configuration, there is no limitation.

- If the existing bridge has been used in a configuration different to 6-pulse , additional engineering is needed. It should be checked at first, if a standard converter DCS800-S0x can be used for such a configuration. Most likely the DCS800-R0x can be designed similar as with a standard converter.
- There are drives used in the past in a configuration sometimes named MASTER - FOLLOWER or MASTER - SLAVE or similar. In all these applications, one drive had generated references or commands for the second, third etc. The Rebuild kit is basically prepared for those configurations; the final wiring may be different. For more details, please refer to the documentation.
- If the existing converter has been used in a non motor application most often a prepared solution is not available, but most often an engineered solution can be found. Please contact your local ABB engineering organization.

Type coding and accessories

There is only one mechanical construction for all the different versions of the kit. It basically serves as a cover for that part named DCS800-R0x on the next figure. Ordering of the kit is done with the ordering code shown on the right page. The options available for the Rebuild kit are identical as for a DCS800-S0x converter. Some options (e.g. +K454 adapter module for PROFIBUS DP communication) will be build in if ordered, some will come within the kits box and others need to be specified seperate and will come in a separate box.
All applications, which can be done with a DCS800 converter, can be done with this DCR kit too, as long as the components, necessary for that application can be used for both systems. Engineering help is given within the DCS800 converter module´s documentation (see inner page of the jacket of this manual). This manual just focuses on items related to the engineering of the Rebuild kit.

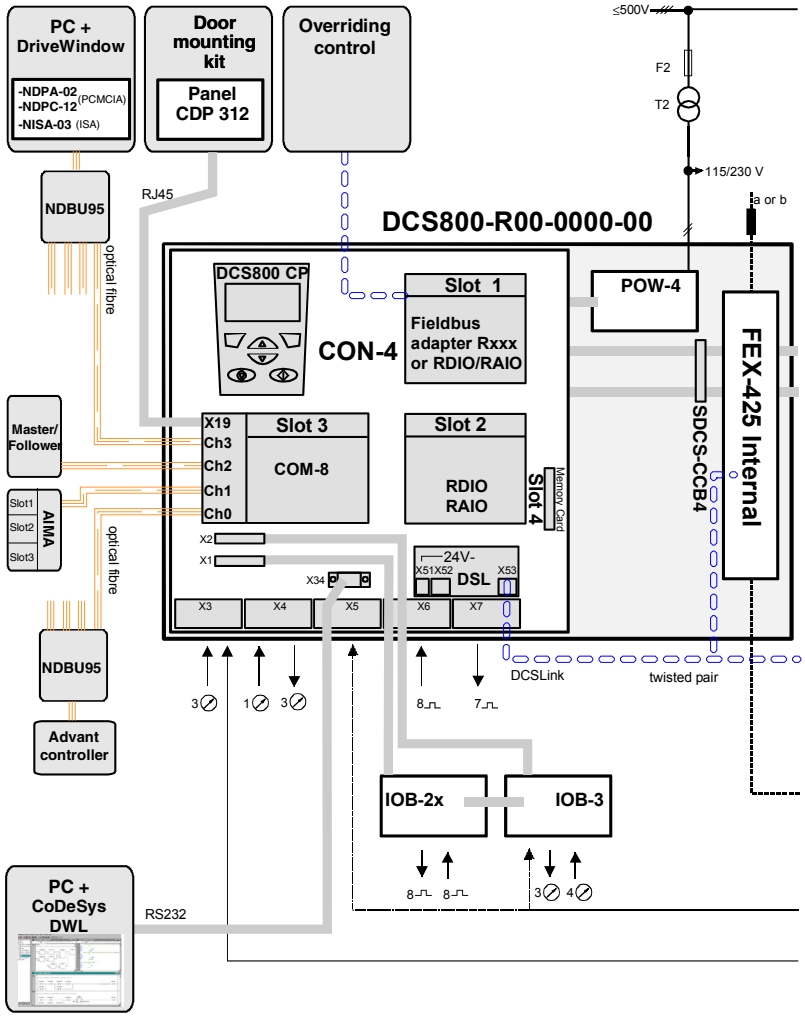


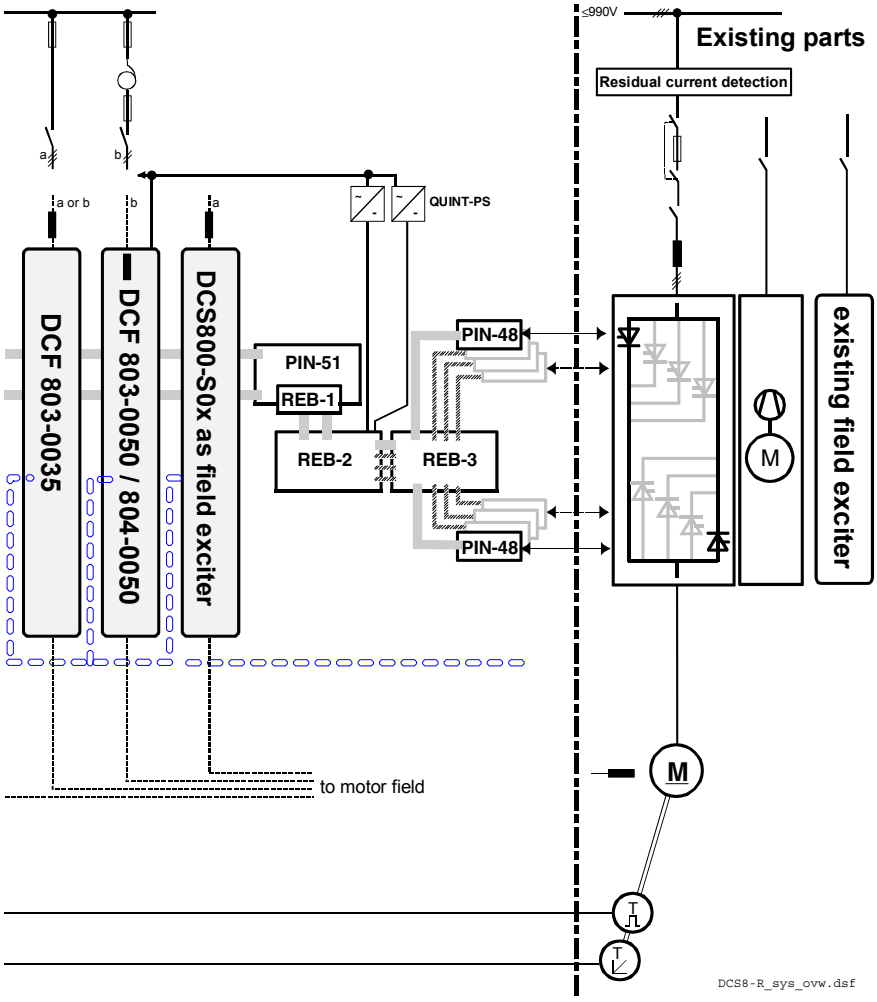
*Figure 1: Overview of **DCS800-R** System*

Ordering code:

DCS800 - R0 1 - 0000 - 01 + 0000

DC Drives
Product family
DCS800 converter
Rebuild kit
Bridge type
1 = single (2Q)
2 = anti (4Q)
Number of parallel / antiparallel thyristors
01 = 1 bridge
02 = 2 bridges in parallel
03 = 3 bridges in parallel
04 = 4 bridges in parallel
Options
+xxxx codes according list for add-on options

selectable option



*Overview of **DCS800-R** System*

Hardware

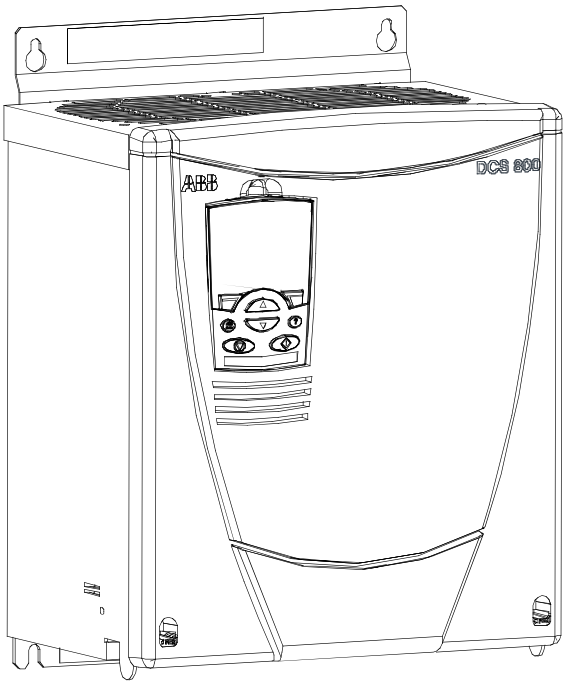
This chapter gives information about all the components and boards being exclusively used at the DCS800-R0x kit. Components which are used at DCS800-S0x converter modules are just mentioned within that chapter, but not described in detail. In case those components need special handling it will be listed here. This for example is valid for measuring actual signals at the existing power stack or doing the galvanic isolation for the firing pulse transmission.
In addition to that environmental conditions, dimensions and some hints are listed for better and straighter forward engineering.
All other components which may come or may had been ordered together with the kit are described in detail either within the *DCS800 Hardware Manual* or within their dedicated documentation.

Basic components of the DCS800-R kit

The kit is ordered according to the type designation at chapter *Basic Selection*.
The delivery can be subdivided into several parts, mostly two:
- rebuild kit´s main electronics already pre-assembled
- electronic boards and cables to measure signals at the power part and control the existing thyristors; this will come as loose parts

The interface towards the PLC can be done via inputs / outputs. In this case optional parts may be added.

Housing for main electronics



DCS800-R0x kit´s main electronics, named DCS800-R00-0000-00

Pre-assembled part

This part is pre-assembled and consists of:

- Housing for electronics (as shown on figure before)
- Control board SDCS-CON-4 built-in
- Electronic power supply SDCS-POW-4 built in (including flat cable to SDCS-CON-4). This board needs to be feed by a 2-phase AC line voltage, either 115 V or 230 V
- Drive-to-drive interfacevia SDCS-DSL-4 board
- Control panel DCS800 CP
- Flat cable interconnection board SDCS-CCB4

Hint: The older version of the electronic power supply SDCS-POW-1 can be used as a spare part for the actual one, SDCS-POW-4.

As shown at the end of chapter *Basic Selection* some options can be ordered using a so called *plus code*. Such options most often can only be used together with the controller board; sometimes they need to be plugged on the controller board to get their function. Those options will be put at their correct place during production and therefore will come within the housing.
Plug-in modules (e.g. Prfibus, I/O extensions) and the field supply FEX-425 Internal are parts handled by plus codes.

Loose parts

The kit is available as a 2-Q or 4-Q version. Both of them are available for power parts with one up to four thyristors in parallel. Because of the different versions some components will be part of the delivery in every case like the SDCS-PIN-51 and SDCS-REB-1 board, others depend on the configuration:

DCS800-R01	-0000-01 (1 bridge)	-0000-02 (2 bridges)	-0000-03 (3 bridges)	-0000-04 (4 bridges)
(2-Q)	1x PIN-48 - - - - - - - -	2x PIN-48 2x QUINT-PS 1x REB-2	3x PIN-48 2x QUINT-PS 1x REB-2	4x PIN-48 2x QUINT-PS 1x REB-2
DCS800-R02	-0000-01 (1 bridge)	-0000-02 (2 bridges)	-0000-03 (3 bridges)	-0000-04 (4 bridges)
(4-Q)	2x PIN-48 - - - - - - - -	4x PIN-48 2x QUINT-PS 1x REB-2	6x PIN-48 2x QUINT-PS 1x REB-2	8x PIN-48 2x QUINT-PS 1x REB-2

The boards serve for different purposes:

- **SDCS-PIN-48:**
  Pulse transformer board is mounted on a card holder. For the interconnections 6 firing leads (twisted pair; system plug on one end) and a shielded flat cable (round; 20-pole) will come with the kit. For cable length, please refer to chapter *Installation*.
- **SDCS-PIN-51:**
  Measuring board is mounted on a card holder. For the interconnections 5 leads for the AC and DC voltage measurement (single core; 6,3 mm faston on one end), 2 leads for the current measurement (twisted pair; system plug on one end), 2 shielded flat cable (round; 16 pole) and a pluggable resistor for X22 will come with the kit. For cable length, please refer to chapter *Installation*.
- **SDCS-REB-1:** (Interface board)
- **QUINT-PS:** (Power supply)
- **SDCS-REB-2:**
  Pulse amplification board for more than one bridge in parallel is mounted on a card holder. For the interconnections 2 flat cables (20-pole) will come with the kit. For cable length, please refer to chapter *Installation*.

Optional parts

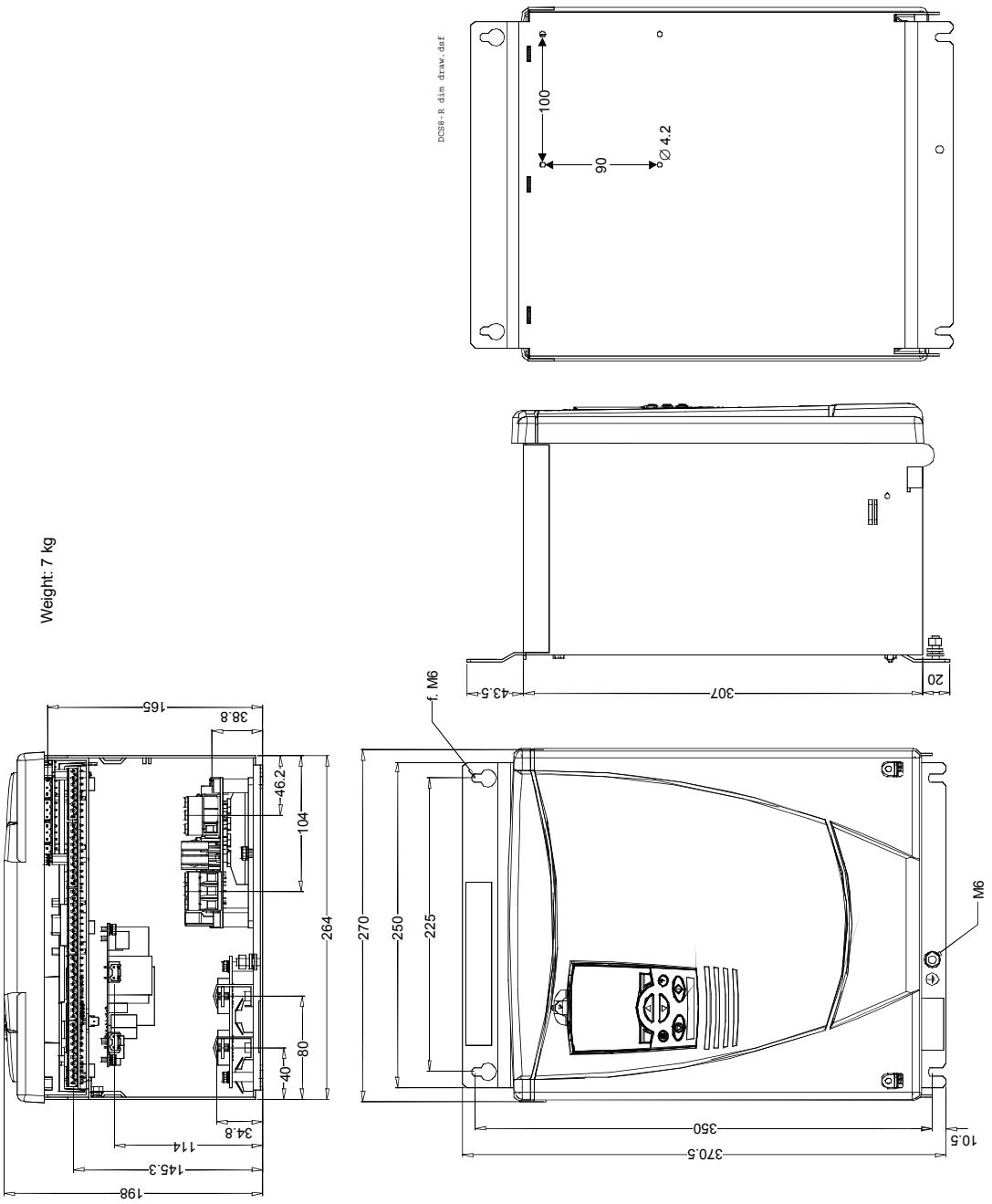
The options available differ in their usage. Some of them are related to the rebuild kit, some to the drive itself or to the application the drive is used for:

- **Subassembly SDCS-REB-3:**
  This board is used together with the SDCS-REB-2 and SDCS-PIN-48. With the help of this board the firing pulse assignment can be changed and adapted to the needs given by the existing power part construction. The board will come mounted on a card holder. For the interconnections 4 flat cables (20-pole) will come with the kit. For cable length, please refer to chapter *Installation*.
- **Plus code +S164 (FEX-425 Internal):**
  This field supply can be build into the electronic housing. When ordered using the plus code it will be mounted inside the housing during production. The board can be connected to any 2- or 3-phase power supply with up to 500V.
  Power rating:
  with 2-phase supply: 16A max !
  with 3-phase supply: 25A max !
  When doing the engineering please make sure all conditions for the power supply configuration are taken into consideration.
- **Subassembly SDCS-IOB-2x/IOB-3:**
  This subassembly is a part of the accessories of the DCS800-S0x converter module. In case the inputs or outputs available at the controller board directly do not fulfill the criteria concerning the input or output voltage range or the criteria of the input / output to ground this option may be a solution.
  The subassembly needs to be placed close to the electronic housing.

Depending on the overall configuration and the needs caused by the application itself it may be necessary to add other options. These options should be selected based on the overview of the DCS800-R system shown at the end of chapter *Basic Selection*.

Dimensions main electronic housing

The electronics housing is just equipped with these components mentioned before. There is no cooling fan. Nevertheless based on the components build in natural convection is necessary to keep the temperature of the used components within the limits. Because of that it is important to mount the housing as shown on the figure before and to make sure the convection is not blocked.



Dimensional drawing of the DCS800-R

Environmental conditions

The next tables describe the technical specifications of the product, e.g. the ratings, sizes and technical requirements, provisions for fulfilling the requirements for CE and other markings.

Remark:

This chapter with exactly the same lay-out is used for all subsets of the system DCS800. Because of this only headlines without (*) are applicable to the product DCS800-R !

System connection

Voltage, 3-phase:	230 to ≤ 1000 V acc. to IEC 60038
Voltage deviation:	±10% continuous; ±15% short-time *
Rated frequency:	50 Hz or 60 Hz
Static frequency deviation:	50 Hz ±2 %; 60 Hz ±2 %
Dynamic: frequency range:	50 Hz: ±5 Hz; 60 Hz: ± 5 Hz
df/dt:	17 % / s

* = 0.5 to 30 cycles.

Please note: Special consideration must be taken for voltage deviation in regenerative mode.

Degree of protection

Converter Module and options (line chokes, fuse holder, field supply unit, etc.):	IP 00 / NEMA TYPE OPEN
Enclosed converters: **(*)**	IP 20/21/31/41

Paint finish (*)

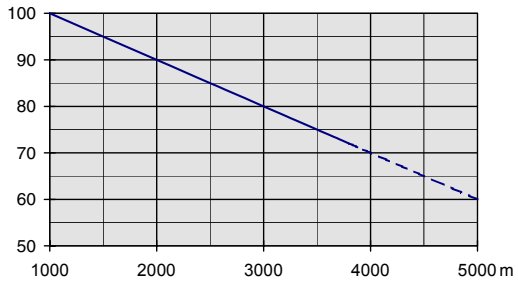
Converter module:	light grey RAL 9002
Enclosed converter:	light grey RAL 7035

Environmental limit values

Permissible cooling air temperat.	
- at converter module air inlet:	0 to +55°C
with rated DC current: **(*)**	0 to +40°C
w. different DC curr. acc. Fig. below: **(*)**	+30 to +55°C
- Options:	0 to +40°C
Relative humidity (at 5...+40°C):	5 to 95%, no condensation
Relative humidity (at 0...+5°C):	5 to 50%, no condensation
Change of the ambient temp.:	< 0.5°C / minute
Storage temperature:	-40 to +55°C
Transport temperature:	-40 to +70°C
Pollution degree (IEC 60664-1, IEC 60439-1):	2
Vibration class	3M3 - D1...D4 3M1 - D5...D7
Site elevation	
<1000 m above M.S.L.:	100%, without current reduction
>1000 m above M.S.L.:	with curr. reduct., see Fig. below

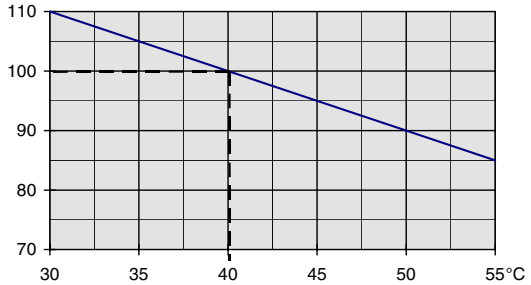
Size	Sound pressure level LP (1 m distance) **(*)**		Vibration	Shock	Transport in original package **(*)**	**Short circuit withstand rating (*)** The DCS800 is suitable for use in a circuit capable of delivering not more than:
	as module	enclosed conv.	as module			
D1	55 dBA	54 dBA	1.5 mm, 2...9 Hz 0.5 g, 9...200 Hz	7 g / 22 ms	1.2 m	65 kA rms symmetrical amps at maximum 600 VAC
D2	55 dBA	55 dBA				
D3	60 dBA	73 dBA			1.0 m	
D4	66...70 dBA, depending on fan	77 dBA				
D5	73 dBA	78 dBA	0.3 mm, 2...9 Hz 0.1 g, 9...200 Hz	4 g / 22 ms	0.25 m Shock monitor	100 kA rms symmetrical amps at maximum 600 VAC
D6	75 dBA	73 dBA				
D7	82 dBA	80 dBA				

Effect of the site elevation above sea level on the converter's load capacity **(*)**



Current reduction to (%)

Effect of the ambient temperature on the converter module load capacity **(*)**



Current reduction to (%) for converter modules

Regulatory Compliance (*)

The converter module and enclosed converter components are designed for use in industrial environments. In EEA countries, the components fulfil the requirements of the EU directives, see table below.

European Union Directive	**Manufacturer's Assurance**	Harmonized Standards	
		Converter module	Enclosed converter
Machinery Directive			
98/37/EEC 93/68/EEC	Declaration of Incorporation	EN 60204-1 [IEC 60204-1]	EN 60204-1 [IEC 60204-1]
Low Voltage Directive			
73/23/EEC 93/68/EEC	Declaration of Conformity	EN 61800-1 [IEC 61800-1] EN 60204-1 [IEC 60204-1]	EN 60204-1 [IEC 60204-1] EN 60204-1 [IEC 60204-1]
EMC Directive			
89/336/EEC 93/68/EEC	Declaration of Conformity (Provided that all installation instructions concerning cable selection, cabling and EMC filters or dedicated transformer are followed.)	EN 61800-3 ① [IEC 61800-3]	EN 61800-3 ① [IEC 61800-3]
		① in accordance with 3ADW 000 032	① in accordance with 3ADW 000 032/3ADW 000 091

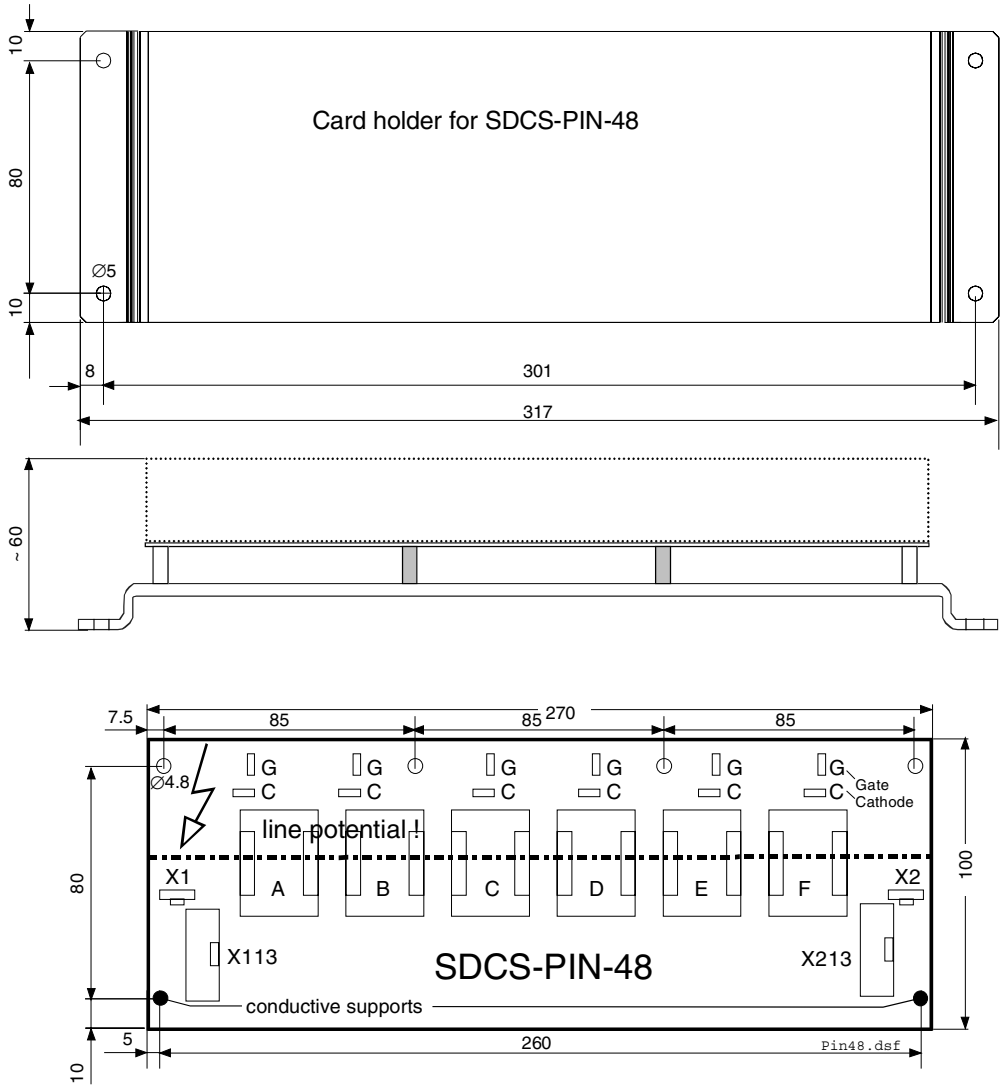
North American Standards (*)

In North America the system components fulfil the requirements of the table below.

Rated supply voltage	Standards	
	Converter module	Enclosed converter
to 600 V	• see UL Listingwww.ul.com / certificate no. E196914 Approval: $_{c}UL_{us}$ The spacings in the modules were evaluated to table 36.1 of UL 508 C. Spacings also comply with table 6 and table 40 of C22.2 No. 14-05. • or on request	UL types: on request
>600 V to 990 V	EN / IEC xxxxx see table above. Available for converter modules including field exciter units.	EN / IEC types: on request (for details see table above)

Pulse transformer board SDCS-PIN-48

This board is always required with the rebuild kit.
Normally one SDCS-PIN-48 board per 6 thyristors, if the board can be placed close (gate wires <1 m) to all 6 thyristors of one bridge.



SDCS-PIN-48 board and card holder

Wiring

The gate-cathode wires, which are a part of the rebuild kit's delivery, have to be handled in this way:

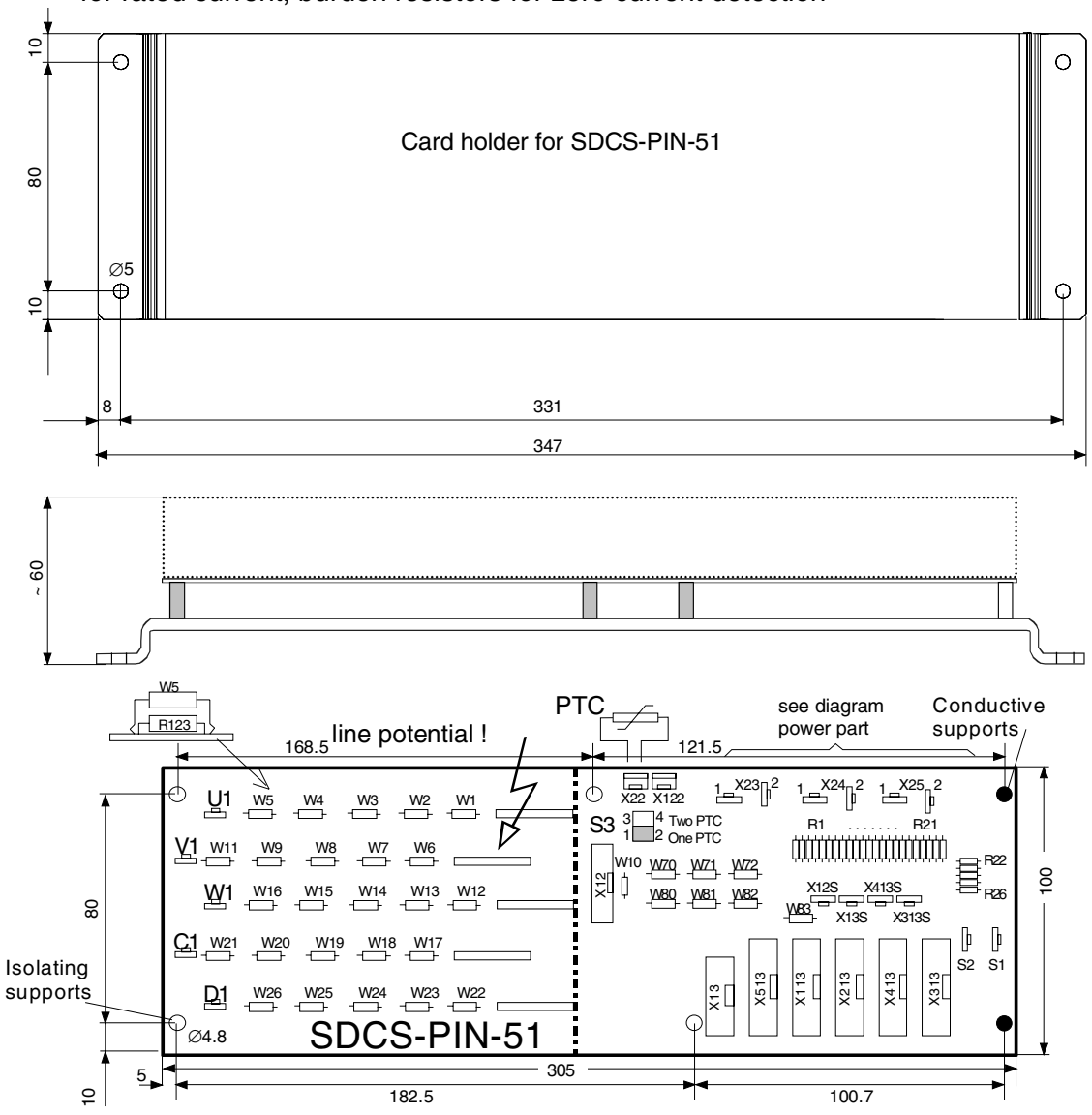
- One end is equipped with a coded plug, which fits the C and G pins on the SDCS-PIN-48
- The cable length in the delivery condition is 2 m. The cable routing should be done, to end up with a cable length as short as possible; the max. cable length is 1 m. The cables have to be shortened and have to be equipped with the plug connector, demanded by the thyristor type in use.

Measurement board SDCS-PIN-51

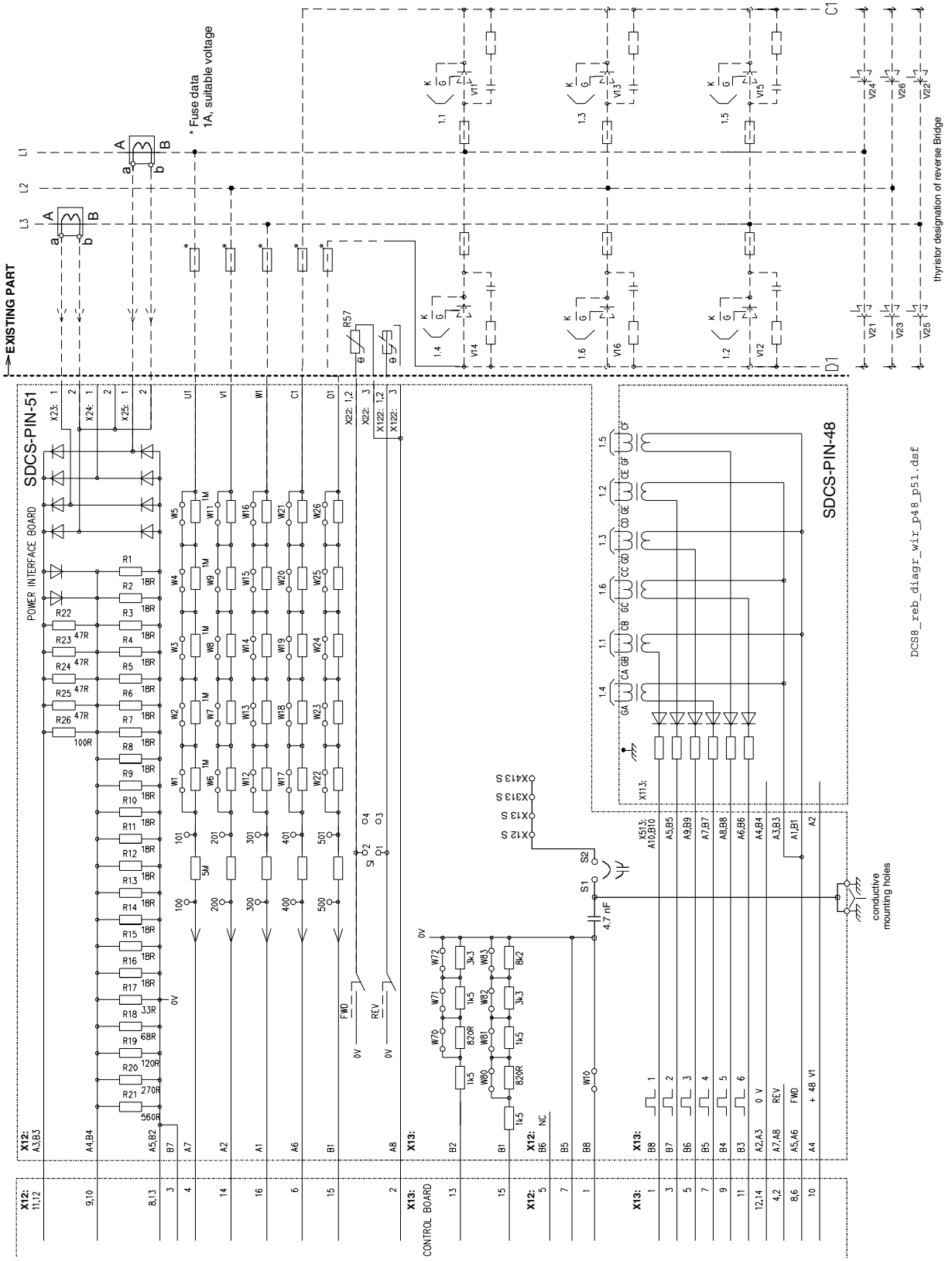
This board is always required with the rebuild kit.
One SDCS-PIN-51 board per kit.

The SDCS-PIN-51 board contains following functions:

- Connection to pulse transformer board / boards
- Interface for heat sink temperature measurement with a PTC resistor
- Measurement and scaling of AC and DC voltage via high ohmic resistors
- Measurement of the armature current and scaling with burden resistors to 1.5 V for rated current; burden resistors for zero current detection



SDCS-PIN-51 board and card holder



Typical rebuild connection with controller board, SDCS-PIN-48 and SDCS-PIN-51 boards

Wiring

If the distance between the SDCS-PIN-51 terminals C1, D1, U1, V1, W1 and the power terminals of the existing power part exceeds 1 m, an additional fuse has to be used per wire (see fig. before). Make sure a jumper is installed connecting faston point S1 with S2 ! This connection is essential for proper grounding of the flat cables x12: and X13:.

Fastening

The boards SDCS-PIN-48 and SDCS-PIN-51 will come with a card holder, which has got six M4 mounting holes. Using this card holder care must be taken to have a good connection to ground! When mounting these boards without card holder (the figures for the corresponding boards shown before) show which of the holes have to be grounded and which have to be isolated. 15 to 20 mm long metal stand-offs and insulation stand-offs have to be used. The insulation clearance must be rated for 990 V AC working voltage.

PTC temperature sensor

Normally there is no temperature sensor in existing converters; in this case, a separate resistor (2.21 kohm; 0.5 W; 1%; delivered with the kit) must be connected between terminals X22:1 and X22:3 on SDCS-PIN-51; jumper S3 on the same board must be in position 1-2. Because of this, the temperature measurement reads a fixed value and is out of operation.
Some kind of power part monitoring can be designed by using optional devices. For more information see chapter *Special Accessories.*

HW type coding

- All jumpers W70 to W72 and W80 to W83 and W10 should be kept untouched (default condition).
- In case a board should be used, which had been in operation or which had been coded why ever reason with the above listed jumpers no additional actions need to be done. It can be used without further modification; just leave the jumpers as they are. They will not be read by the converter´s software and therefore not taken into calculation.

Voltage coding

Use the settings given by the next table. Depending on the line voltage applied to the existing power stack the jumpers need to be removed accordingly (lower line voltage scaling on request).

Note:

At existing power parts with high supply voltage the option **galvanic isolation** should be taken into consideration because of personal and functional safety reasons.

Voltage applied to the power stack	appr. 200...500 V	501...600 V	601...700 V	701...800 V	801...990 V
Value for S ConvScaleVolt (97.03)	500	600	690	800	1000
W1, 6, 12, 17, 22	⊖—⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖
W2, 7, 13, 18, 23	⊖—⊖	⊖—⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖
W3, 8, 14, 19, 24	⊖—⊖	⊖—⊖	⊖—⊖	⊖✕⊖	⊖✕⊖
W4, 9, 15, 20, 25	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖✕⊖
W5, 11, 16, 21, 26	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖✕⊖

⊖✕⊖ indicates a removed jumper

Nominal current coding

At first make sure, that the current transformers are mounted and wired according to the figure before.

In addition to that two other definitions are important:

- **the nominal current I_{dN} is equivalent to 1.5 V across the nominal current burden resistors**
- **the current measurement is designed to handle peak currents up to two-times of I_{dN}**

Most often the current I_{dN} is the thermal current of the existing power part (thyristor stack); the peak current may be the highest current running through the motor.

- **If the peak current is higher than two-times I_{dN} the nominal current needs to be redefined.**

  The value $I_{dNDCR} = 0.5 * I_{peak}$ has to be used instead of I_{dN} at all the next equations!

- The scaling for nominal current will be done by the resistors R1 to R21, which are connected in parallel.

If the ratio of the current transformer is **either** 2500:1 or 4000:1

The next table lists some burden resistor settings based on two types of current transformers (2500:1 and 4000:1) and some values for the nominal current I_{dN}.

As long as the nominal current of the power stack is close to these currents and the current transformers are identical as listed below this option for coding the current should be used!

In such a case remove the jumpers on the SDCS-PIN-51 board according to the current selected and set parameter S ConvScaleCur (97.02) to exactly that selected rated current.

Current transf. ratio			2500:1						4000:1				
Nominal current I_{dN} [A]			900	1200	1500	2000	2500	3000	2600	3300	4000	4800	5200
R1-R4	18 Ω	Rated current scaling	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R5	18 Ω		⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R6	18 Ω		⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R7	18 Ω		⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R8	18 Ω		⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R9	18 Ω		⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R10	18 Ω		⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖
R11	18 Ω		⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖
R12	18 Ω		⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖
R13	18 Ω		⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖
R14	18 Ω		⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖
R15	18 Ω		⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖
R16	18 Ω		⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖
R17	33 Ω		⊖✕⊖	⊖—⊖	⊖✕⊖	⊖—⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖✕⊖	⊖—⊖	⊖—⊖
R18	68 Ω		⊖—⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖
R19	120 Ω		⊖✕⊖	⊖—⊖	⊖—⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖
R20	270 Ω		⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖✕⊖	⊖—⊖	⊖✕⊖	⊖—⊖	⊖✕⊖	⊖—⊖
R21	560 Ω		⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖—⊖	⊖✕⊖	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖✕⊖	⊖✕⊖
R22	47 Ω	Zero current detection	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R23	47 Ω		⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R24	47 Ω		⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R25	47 Ω		⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R26	100 Ω		⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖

⊖✕⊖ indicates a removed jumper

DCS800-R volt & curr coding.dsf

Hint:
In case a DCS800-R0x will be used to replace a DCR500B or DCR600 keep the coding of the SDCS-PIN-51 board as done in the past and set parameter 97.02 exactly to that value the SDCS-PIN-51 board was coded.
The zero current detection is done on the controller board SDCS-CON-4. Because of that the resistors available for that function need not to be coded!

If the ratio of the current transformer is **different to** 2500:1 or 4000:1

Calculate the total burden resistance R_{br}:

$$R_{br} = \frac{1{,}5V}{I_{dN}} * roct$$

with: I_{dN} = nominal current of power part
$roct$ = ratio of current transformer

Calculate the resistors to be cut off within R1 to R21 according to the next formula. The resulting resistance R_r should be as close as possible to the burden resistance R_{br}. If the resulting resistance R_r is smaller than R_{br}, the nominal current $I_{dN}(R_r)$ will be higher than the current the calculation was based on (keep the coding and use the recalculated current at parameter S ConvScaleCur (97.02)):

$$\frac{1}{R_{br}} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} + \frac{1}{R4} + ... + \frac{1}{Rn}$$

Additional settings

The following settings will be done by software parameters:

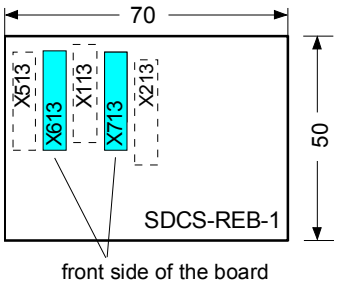
Converter	**Parameter**	Parameter no.	Settings	Remarks
type code	**TypeCode**	(97.01)	**NONE**	
nominal current	**S ConvScaleCur**	(97.02)	xxxxx (A)	as coded
nominal voltage	**S ConvScaleVolt**	(97.03)	xxx (V)	as coded
power stack temperature monitoring	**S MaxBrdgTemp**	(97.04)	**60** (°C)	
2-Q or 4-Q mode	**S BlockBridge2**	(97.07)	**1** **2**	at 2-Q power part at 4-Q power part

Interface board SDCS-REB-1

Using SDCS-REB-1 plugged to SDCS-PIN-51 the firing commands are arranged in such a manner, that one SDCS-PIN-48 gives firing pulses to the six forward bridge thyristors and another one to the six reverse bridge thyristors.

If the REB-1 is plugged on SDCS-PIN-51 board connectors X513, X113 and X213, the board routes the firing pulse so that the pulse transformer board for the forward bridge is connected to X613 and the pulse transformer board for the reverse bridge is connected to X713.

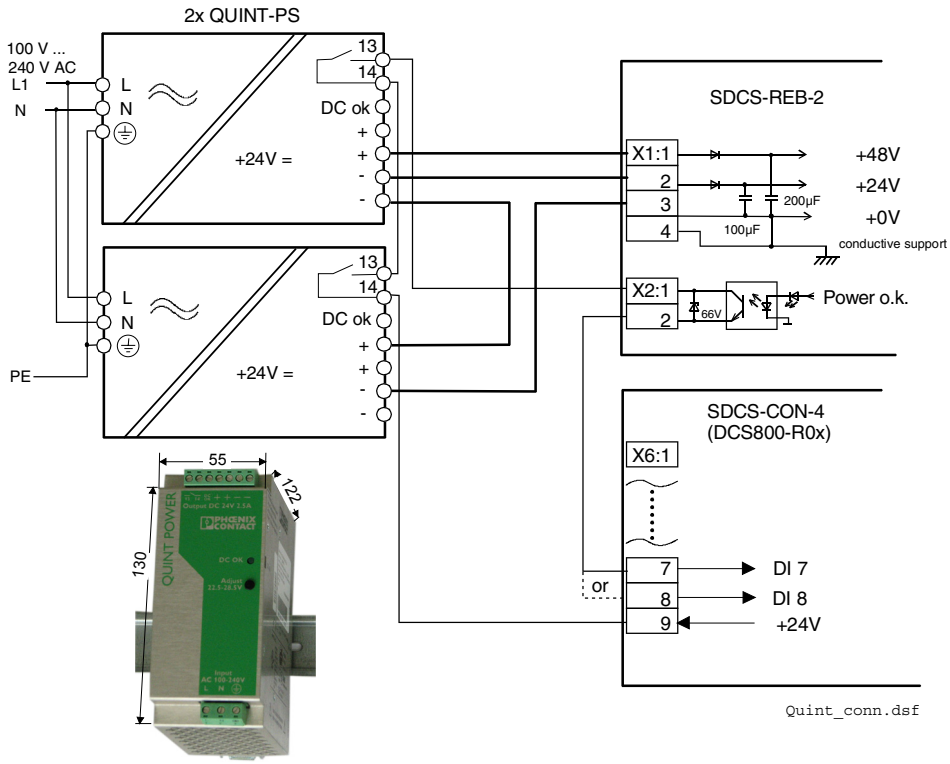
Thyristors in old bridges are often differently positioned on the heat sink than in modern converter modules. At the bigger standard DCS800 modules firing commands are arranged on the pulse transformer board SDCS-PIN-48.
In this way three channels are used for forward bridge and three channels for reverse bridge. This solution keeps the gate leads as short as possible (see chapter *Interfacing the Electronics and Thyristors*).



Layout of the SDCS-REB-1 board

Power supply

The power supply can be made with two +24 V power supplies, wired up in series. For this connection suitable power supply is QUINT-PS; rated +24 V / 2.5 A.



QUINT-PS connection and dimensions

Mounting and wiring of the external power supply:

- the device is cooled by convection; because of that mounting direction is important
- the device needs to be connected to ground (e.g. because of the metal housing, etc.)
- care must be taken for correct wiring and protection of the feeding lines
- for more details see description which comes with the device

Monitoring of the external power supply by the SDCS-REB-2:

- +48 V and +24 V are monitored
- if +48 V is below +41 V and +24 V below +19.5 V then firing pulses are suppressed, the green led V58 is not lit and the transistor switch connected to X2 is open. Normally V58 should be lit and the transistor switch is closed.
- the transistor output rating is 60 V DC/ max. 50 mA; the output is isolated; see figure above

Hint:
The above mentioned monitoring signal should be read by the PLC (programmable logic controller) or connected to an input (one of the 2 inputs, which have a fast update time) of the DCS800-R0x electronics (as indicated above) to handle the COASTING function of the converter. If the supply voltage is o.k. the converter can be released by the PLC. If the supply voltage drops below the threshold, the signal level changes at X2:1 /2. The COASTING function should be activated, which will block the controllers of the converter and force the current to zero as fast as possible for safety reasons. To avoid a blocking and unblocking condition the “power ok” signal should be latched off.
The PLC should release the system depending on other starting conditions.

Functionality

Electrical characteristics of the SDCS-REB-2
- Current requirement for +24 V is 100 mA
- Current requirement for +48 V is 0.4 A for each parallel connected thyristor; if there are 4 parallel thyristors the requirement is about 1.6 A
- The power supply should contain sufficient amount of capacitance so that $\pm$10% secondary voltage tolerance is not exceeded due to voltage ripple; 0 V terminal of the electronics on SDCS-REB-2 is connected to the six mounting holes on the board. Therefore it is grounded.

At the input plug connectors X613 and X713, firing pulse signals 1 to 6 are received, and the current-direction signals SR1 and SR2 as well. The board amplifies these signals and distributes them to 8 plug connectors named X11 to X42. The current direction signal SR1 is assigned to plug connectors Xx1, and current direction signal SR2 to plug connectors Xx2.

Fastening

The SDCS-REB-2 board has six M4 mounting holes. All of them must be grounded using metal stand-offs (see figure *Layout of the SDCS-REB-2 board* below).

Diagram

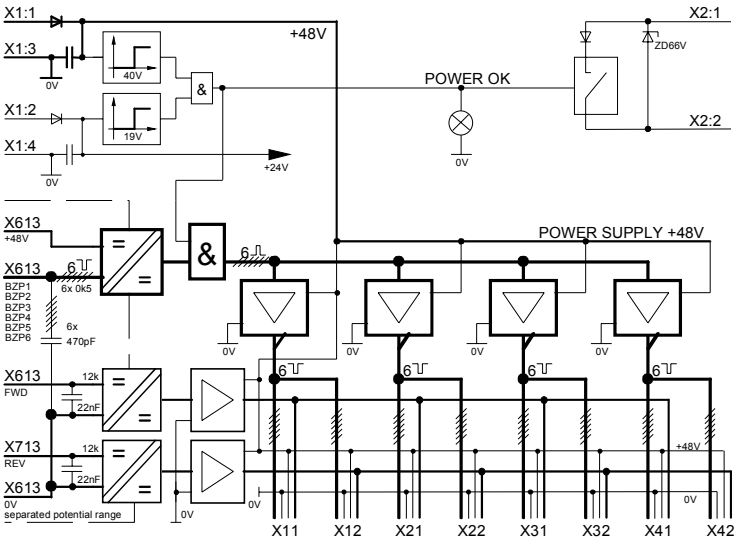
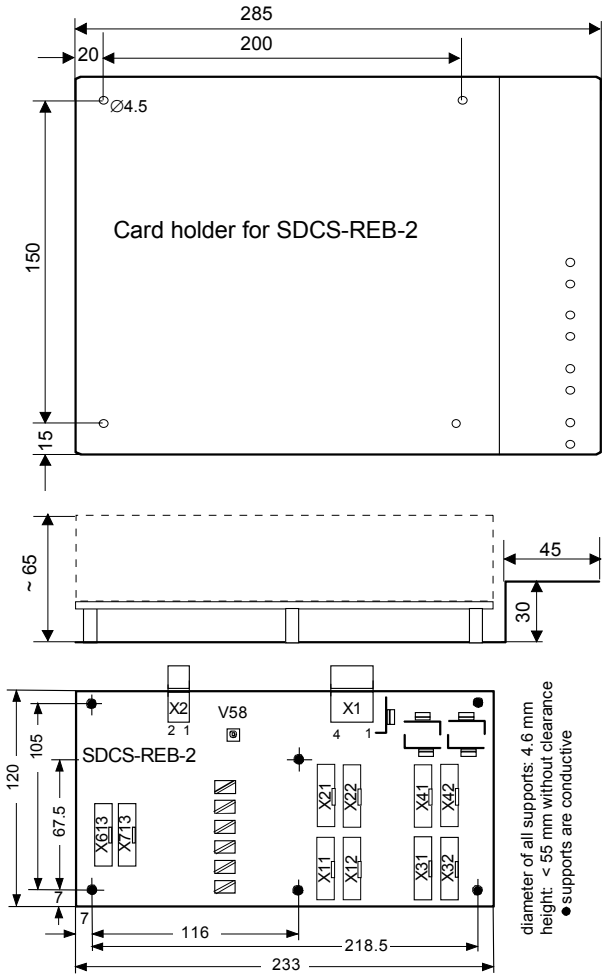


Diagram of the SDCS-REB-2 board



Layout of the SDCS-REB-2 board

Interface board SDCS-REB-3

This board is **not** included in the standard kit. In case the function described later on gives some advantage it needs to be ordered separately!

In a single thyristor bridge the distance between the 6 thyristors and the pulse transformer board is often quite short. The length of these cables, which is limited to 1 meter, is sufficiently long. In big thyristor stages with parallel thyristors the distance can be longer than 1 meter.
In addition to that, there is another reason, which becomes more critical at big thyristor stages. The wiring of the SDCS-PIN-51, SDCS-REB1 and SDCS-REB-2 is designed, that firing pulses for one complete thyristor bridge will be available at SDCS-PIN-48.
To get flexible routing of the firing pulses, the SDCS-REB-3 board comes into use. This board enables the firing pulses to be assigned to the pulse transformers and therefore to the thyristors as well.
If the SDCS-REB-3 board is used, it must be installed between the SDCS-REB-2 and the pulse transformer board SDCS-PIN-48. This board represents a matrix which is used for assigning the current direction signals and the firing pulses received at plugs X11: to X:42 to the output plugs X113: to X813:. If possible try to avoid connecting thyristors of different bridges to the same SDCS-PIN-48. Commissioning and testing will become easier.

At a power part with parallel thyristors each thyristor gets a three digit number. Every digit has the meaning (see chapter *Interfacing the Electronics and Thyristors* figure *Arrangement of thyristors in an anti parallel bridge*):

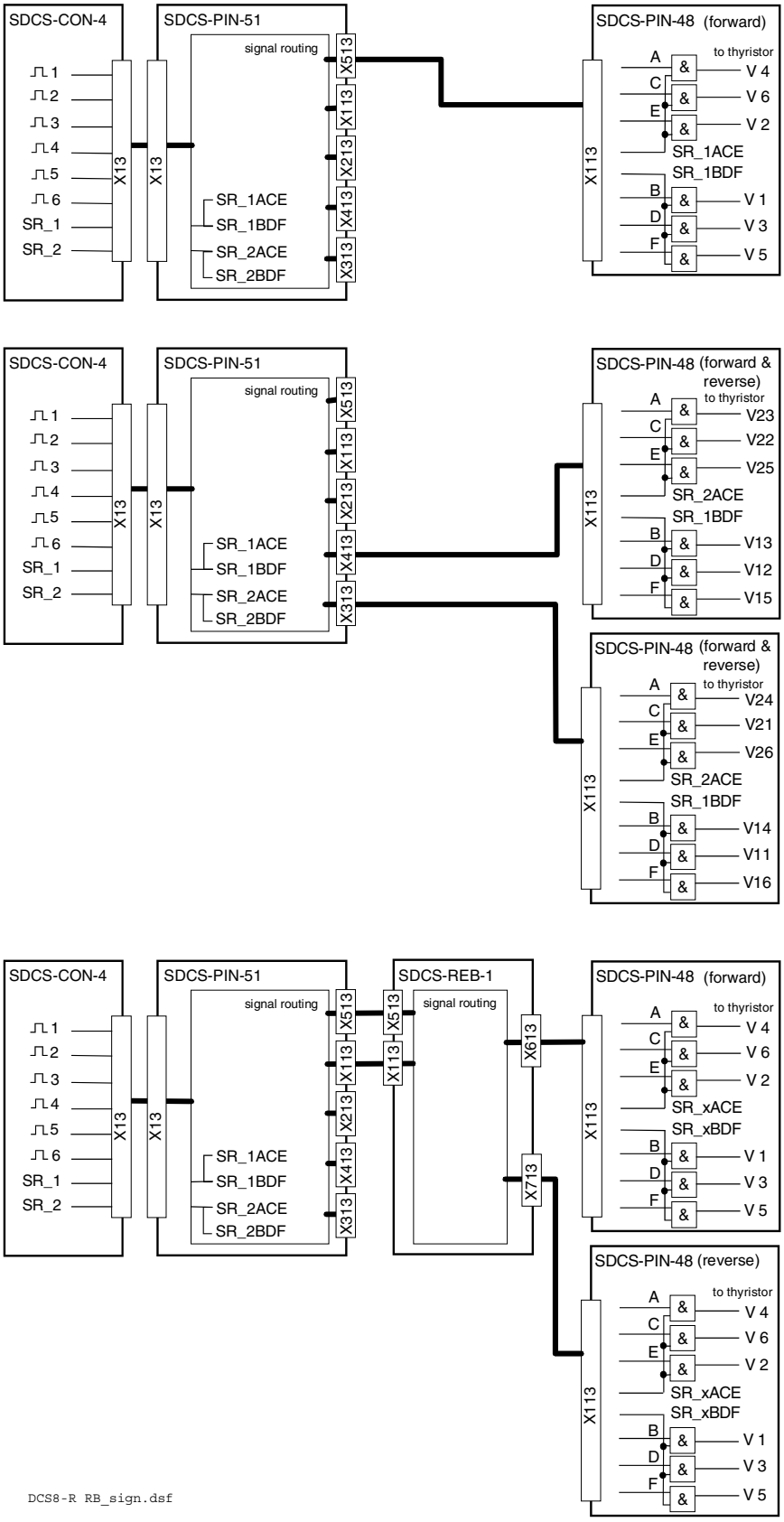
- thyristors named 1xx, 2xx, 3xx or 4xx belong to the first, second, third or fourth bridge
- thyristors named x1x belong to the forward bridge, which is activated by the current direction signals SR_1ACE and SR_1BDF
- thyristors named x2x belong to the reverse bridge, which is activated by the current direction signals SR_2ACE and SR_2BDF
- thyristors named xx1, xx2, up to xx6 indicate the normal firing sequence by their number

Firing pulses

The pulse transformer board SDCS-PIN-48 contains 6 channels numbered A to F. These are in turn subdivided into 2 groups, one with the channels A, C, E and one with the channels B, D, F. These are controlled by two current direction signals. The next figure shows the routing of the firing pulses and the activation of the two groups for three different configurations, used with the bigger standard DCS800-S0x modules.

Signal flow and Thyristor designation

Signal flow of firing pulses and doubling of current direction signals are shown based on the relevant figures in chapter *Interfacing the Electronics and Thyristors*. That results in the thristor designation.



Signal flow of firing pulses and thyristor designation

The following results from this configuration:
- A thyristor receives firing pulses when it has been addressed by one of the signals A to F and by one of the current direction signals SR_Xxxx.
- All members of one group have always to be assigned to the same current direction but not necessarily to the same bridge.

There are four horizontal groups of rows assigned to the input terminals, and eight vertical rows assigned to the output terminals. There is one column for the SR_1 and another one for the SR_2 signal, and eight pair of rows for the outgoing SR_ACE and SR_BDF signals. Penetrations are located in the intersections of these signals, vertical to horizontal. If a wire is inserted in these penetrations and soldered on both sides, an input-to-output connection has thus been established. The multilayer construction used for this board enables this method to be employed.

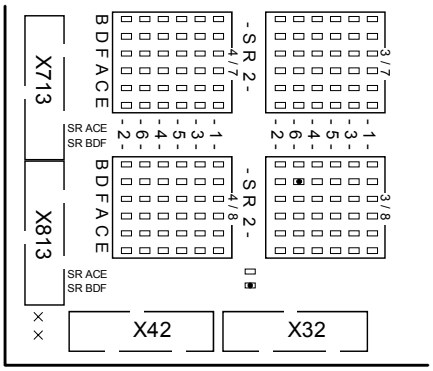
Design hints

- Name the AC terminals of the existing power part
- Name all thyristors according to the list above
- Look for a place, where the SDCS-PIN-48 board can be mounted and make sure, that the distance to the gates of the thyristors does not exceed one meter; the best noise immunity can be achieved with the shortest gate leads
- Assign the thyristors to a firing channel, bearing in mind the group assignments

Signal handling

The handling of the signals, controlling a thyristor is presented by an example:
- *Stipulation*
  - *Thyristor* Vx26 is to be controlled via plug X32: to plug X813: and via channel D of SDCS-PIN-48 board
- *Evaluation*
  - Thyristor Vx26 has been assigned to signal 6
  - Thyristor Vx26 belongs to current direction 2 (SR_2)
  - Channel D has been assigned to group SR_BDF
  - Channels B and F are then likewise assigned to current direction 2

- *Implementation*
  - Solder in pin: row to X813: - intersection SR_2 - SR_BDF
  - Solder in pin: field 3/8 - intersection 6 – D
    (Pins have to be soldered in by inserting the pin, solder it on both sides of the board and shorten the pin)



Signal handling of SDCS-REB-3

- *Check the configuration*
  - A firing pulse amplifier of the SDCS-REB-2 via plug connectors X11, X21, X32 and X42 may operate only one firing pulse transformer per current direction
  - There is only one connecting point allowed per column at a 2-Q system
  - There are only two connecting points allowed per column at a 4-Q system
  - There is only one connection allowed per row
  - Precisely one matrix field with six connections should be assigned per outgoing plug connector (X113...X813).
  - The SR_ACE or SR_BDF outputs of plug connectors X113 to X813 must always be assigned to only one current direction signal, either to SR1 or to SR2

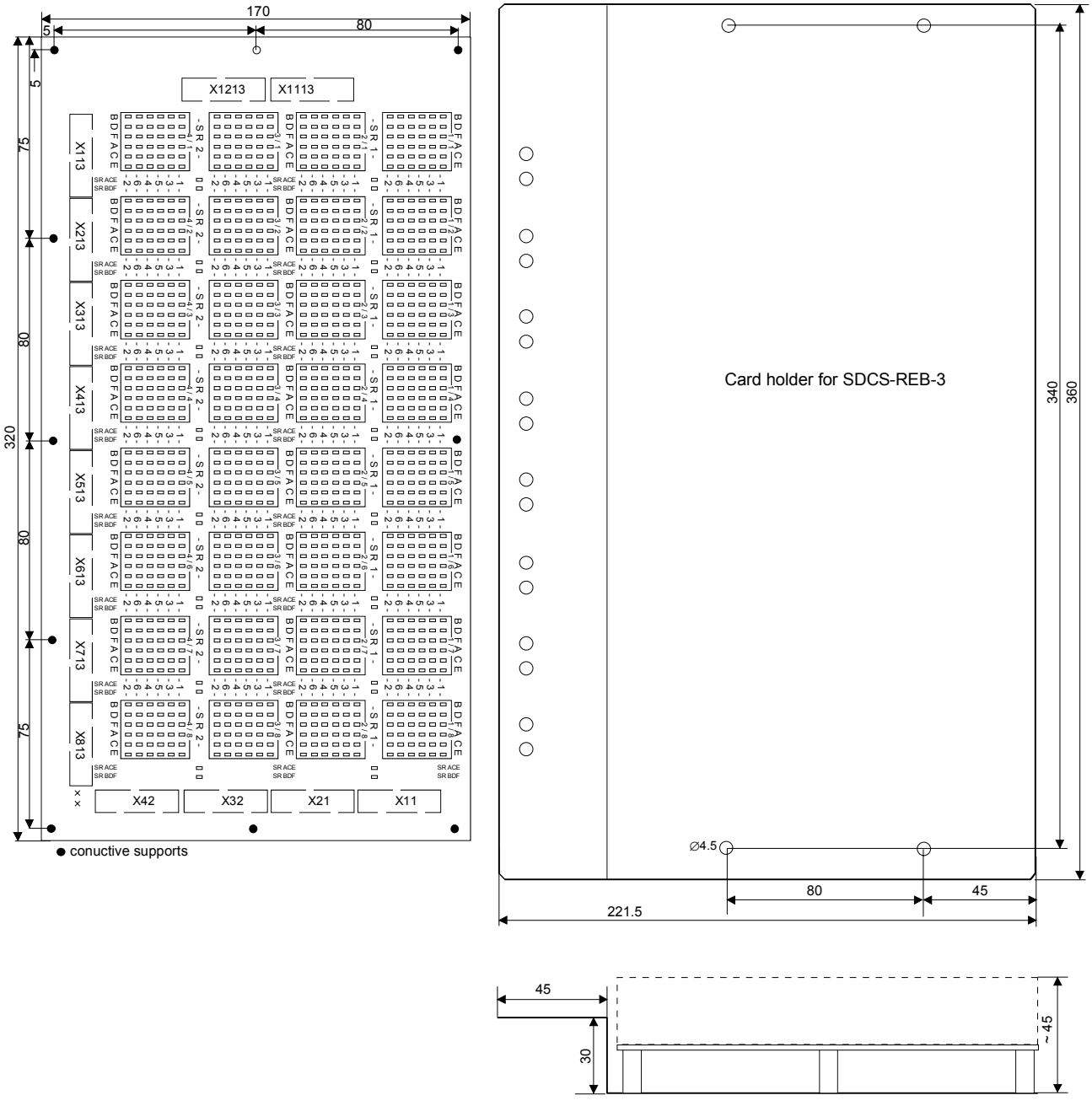
- Assign SDCS-PIN-48 to SDCS-REB-3 board connections
- Configure the SDCS-REB-3 board, complying with the information given by the example
- Inspect visually for clean solder points and remove undesired tin bridges
- Check firing pulses

Plug connectors X1113: and X2113:

These plug connectors are only used in simple applications aiming solely at a redistribution of the firing pulses as compared to and deviating from the standard distribution in modular design. In this variant, REB-1 and REB-2 are dispensed with, with the result that only two anti-parallel thyristor bridges can be controlled.

Fastening

The SDCS-REB-3 has nine fixing holes. All of them must be grounded.

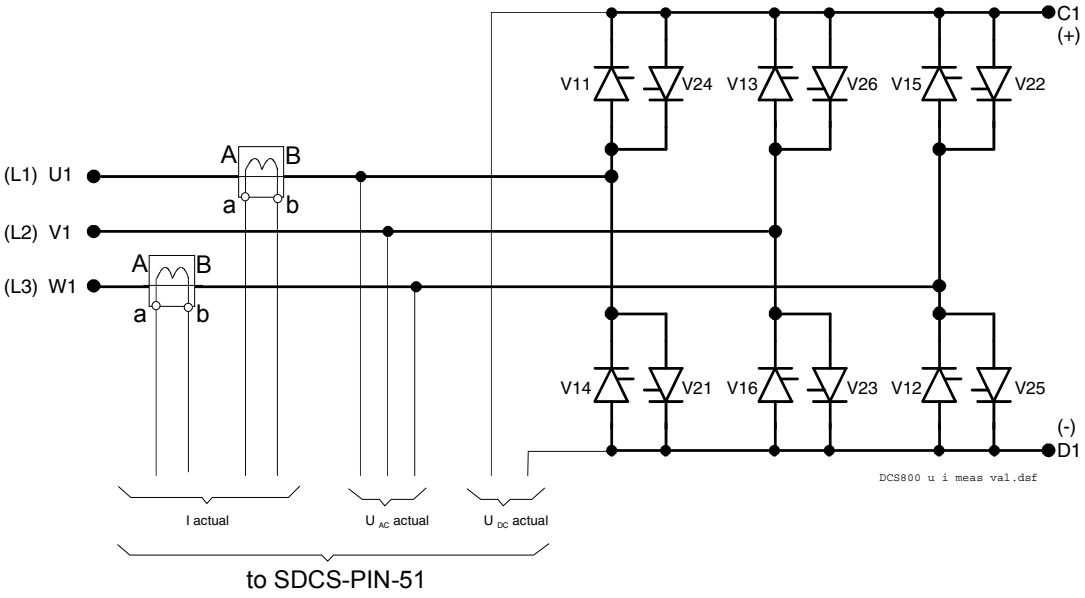


Layout of the SDCS-REB-3 board

Interfacing the Electronics and Thyristors

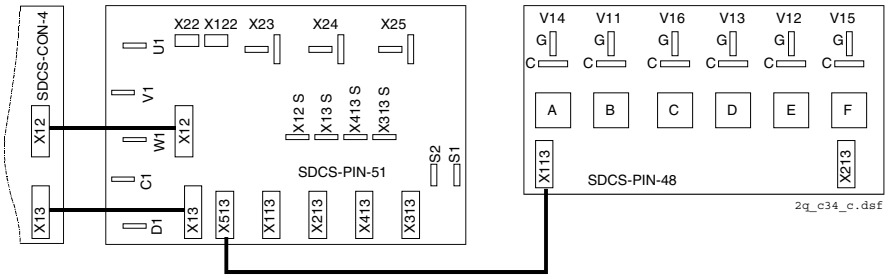
There are several ways to connect the firing commands from the measurement board to the pulse transformer board(s). The assignment of power section, mains connection and wiring to the SDCS-PIN-51 board is mandatory, since the computer board uses this assignment as the basis for computing the pulse sequence. With existing systems, we recommend following our configuration when numbering the semiconductor valves so as to preclude any errors. The arrangement of the thyristors in an anti parallel bridge is presented in the figure below. Thyristors for forward bridge (current direction 1; SR1) are numbered V11, V12...V16 and thyristors for reverse bridge (current direction 2; SR2) are numbered V21, V22...V26.

In two quadrant applications only the forward bridge is existing.



Arrangement of thyristors in an anti parallel bridge

Connection for 2-quadrant application – No parallel Thyristors



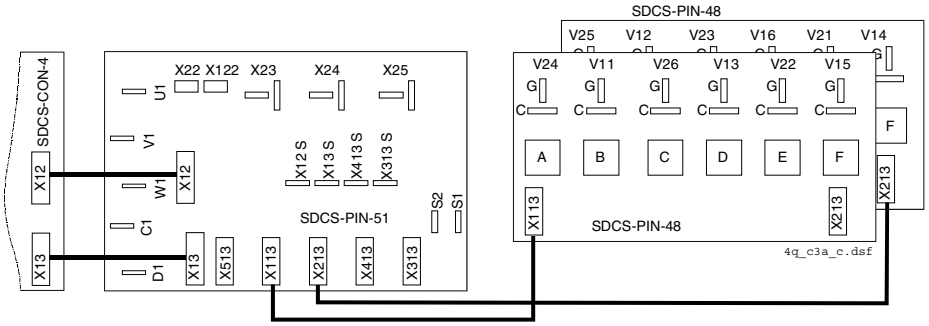
2-quadrant application, no parallel connected thyristors

Connection for 4-quadrant application – No parallel Thyristors

There are three ways shown on the next three figures, how to connect the thyristors, the pulse transformer board(s) and the measuring board to each other.

At figure below the flat cables are connected between
SDCS-PIN-51 X113 to SDCS-PIN-48 X113 and
SDCS-PIN-51 X213 to SDCS-PIN-48 X213,
which gives the result, that

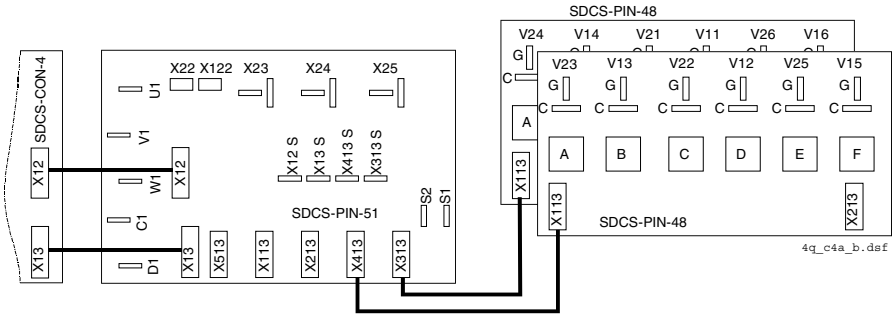
- one SDCS-PIN-48 board transfers all the firing pulses for the thyristors, connected to D1 (see figure *Arrangement of thyristors in an anti parallel bridge*)
- the other SDCS-PIN-48 board transfers all the firing pulses for the thyristors, connected to C1 (see figure *Arrangement of thyristors in an anti parallel bridge*)



Firing pulse assignment

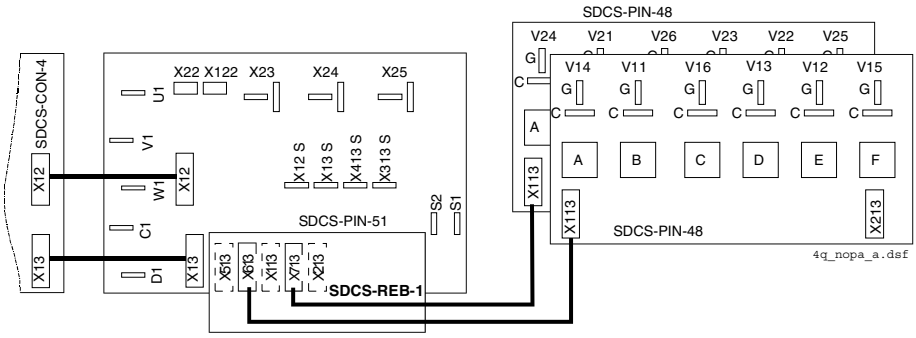
At figure below the flat cables are connected between
SDCS-PIN-51 X413 to SDCS-PIN-48 X113 and
SDCS-PIN-51 X313 to SDCS-PIN-48 X113,
which gives the result, that

- one SDCS-PIN-48 board transfers all the firing pulses for the thyristors, connected to phase L1 and half of the thyristors, connected to phase L2 (see figure *Arrangement of thyristors in an anti parallel bridge*)
- the other SDCS-PIN-48 board transfers all the firing pulses for the rest of the thyristors, connected to phase L2 and for the thyristors, connected to phase L3 (see figure *Arrangement of thyristors in an anti parallel bridge*)



Firing pulse assignment

The connection shown below is used normally when the anti parallel bridge is built by connecting two mechanically separate bridges in an anti parallel configuration. Then gate wiring is most simple and short when all six thyristors of a bridge are connected to one pulse transformer board.

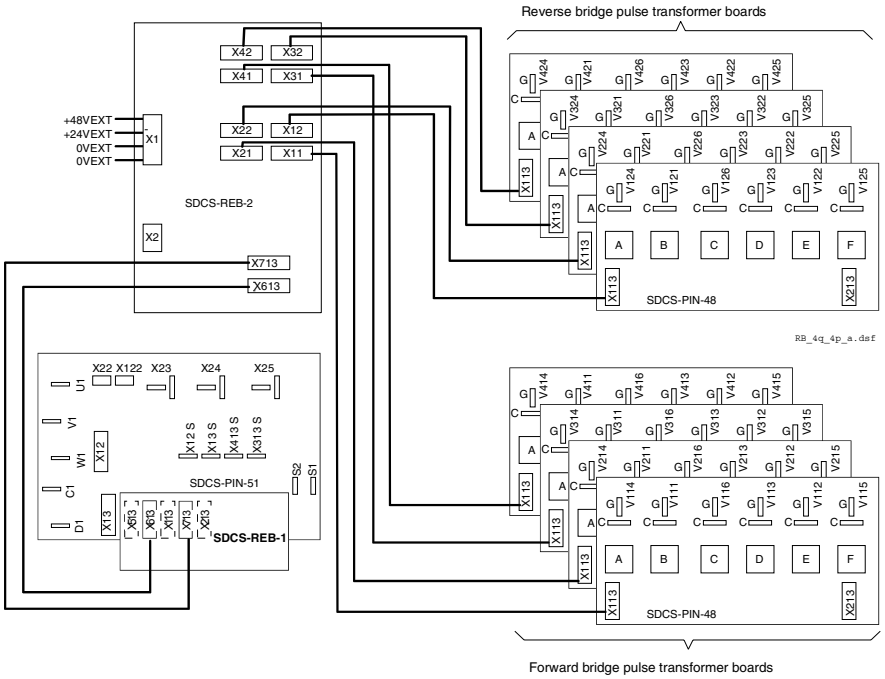


4-quadrant application, no parallel thyristors

Connection for 4-quadrant application - parallel thyristors

With parallel connected thyristors, both additional boards SDCS-REB-1 and SDCS-REB-2 are needed. Because of the REB-2 board external +24V and +48V are needed. The power supply SDCS-POW-4 is not able to give enough power for parallel connected thyristors.

The figure below shows the configuration for a 4-quadrant bridge with 4 parallel connected thyristors.



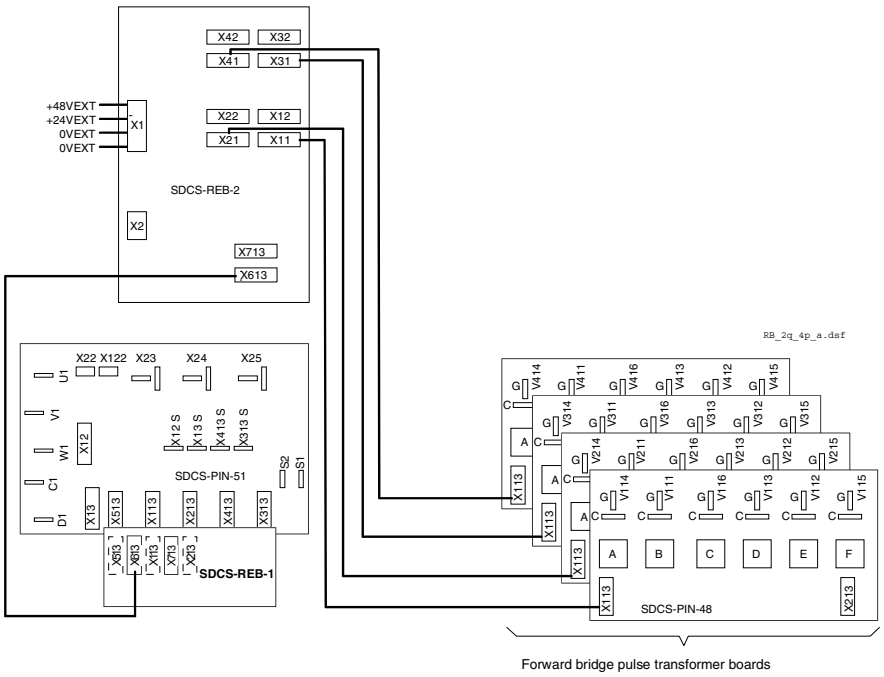
4-quadrant application, parallel thyristors.

Connection for 2-quadrant application - parallel thyristors

With parallel connected thyristors, the additional board SDCS-REB-2 is needed. Because of the REB-2 board external +24V and +48V are needed. The power supply SDCS-POW-4 is not able to give enough power for parallel connected thyristors.

The additional board SDCS-REB-1 can be used, but must not be used. Depending on the final decision the flat cable from X613 (SDCS-REB-2) has to be connected to either X613 (SDCS-REB-1) or X513 (SDCS-PIN-51 with SDCS-REB-1 removed).

The figure below shows the configuration for a 2-quadrant bridge with 4 parallel connected thyristors.



2-quadrant application, parallel thyristors.

Installation

The information given within this chapter shall help the installation personnel to select a place for the different components of the rebuild kit, to mount them and do the interconnections between the boards and the existing hardware.

Background for the figures of this chapter

The figures within this chapter show the different electrical configurations of the kit and give some suggestions for mechanical mounting. On the electrical figures a 4-Q version is drawn:

in case a 2-Q version is in use, the SDCS-PIN-48 boards plus cables for the reverse bridge will not be delivered with the kit (please ignore that part of the figures)

The drawings Figure 4 to Figure 6 differ from the ones afterwards. With the first ones the SDCS-REB-3 board is not shown to indicate, that this board does not need to be used in every case as long as the mechanics allow gate cable length lower than 1m!
Parts which are common for the different configurations are always drawn at the same position. So the parts not needed or not used in the one or the other situation can easily be recognised.

The installation of the kit can be subdivided into 3 parts. Figure 3 is taken as an example and will have these 3 parts marked (read the other pictures in a similar way):

- Part 1 consists of the SDCS-PIN-48 boards, which have to be mounted as close as possible to the thyristors.
- Part 2 covers the SDCS-PIN-51 and the SDCS-REB-2 boards with their accessories. The components within this part may be different depending on the final configuration needed for the existing power part. The cable connections within these boards are quite short; so the boards have to be mounted close to each other, but can be mounted quite far away from the boards used for part 1 or 3. Figure 6 gives a suggestion how the components can be mounted on a metal plate. In case the configuration according to Figure 8 or Figure 9 is used Figure 10 and the following ones will show the mechanical possibilities.
- Part 3 shows the main DCS800-R0x electronics with the electronic power supply SDCS-POW-4 and the microprocessor system SDCS-CON-4. All other options which can be connected to the controller boards are left out for easier reading. They are indicated on the diagrams at chapter *Basic Selection* showing the overall configuration. The detailed description of these options is to be found within the *Hardware Manual*. All components belonging to the third part should be mounted close to each other in the existing drive cabinet (see dimension drawing).

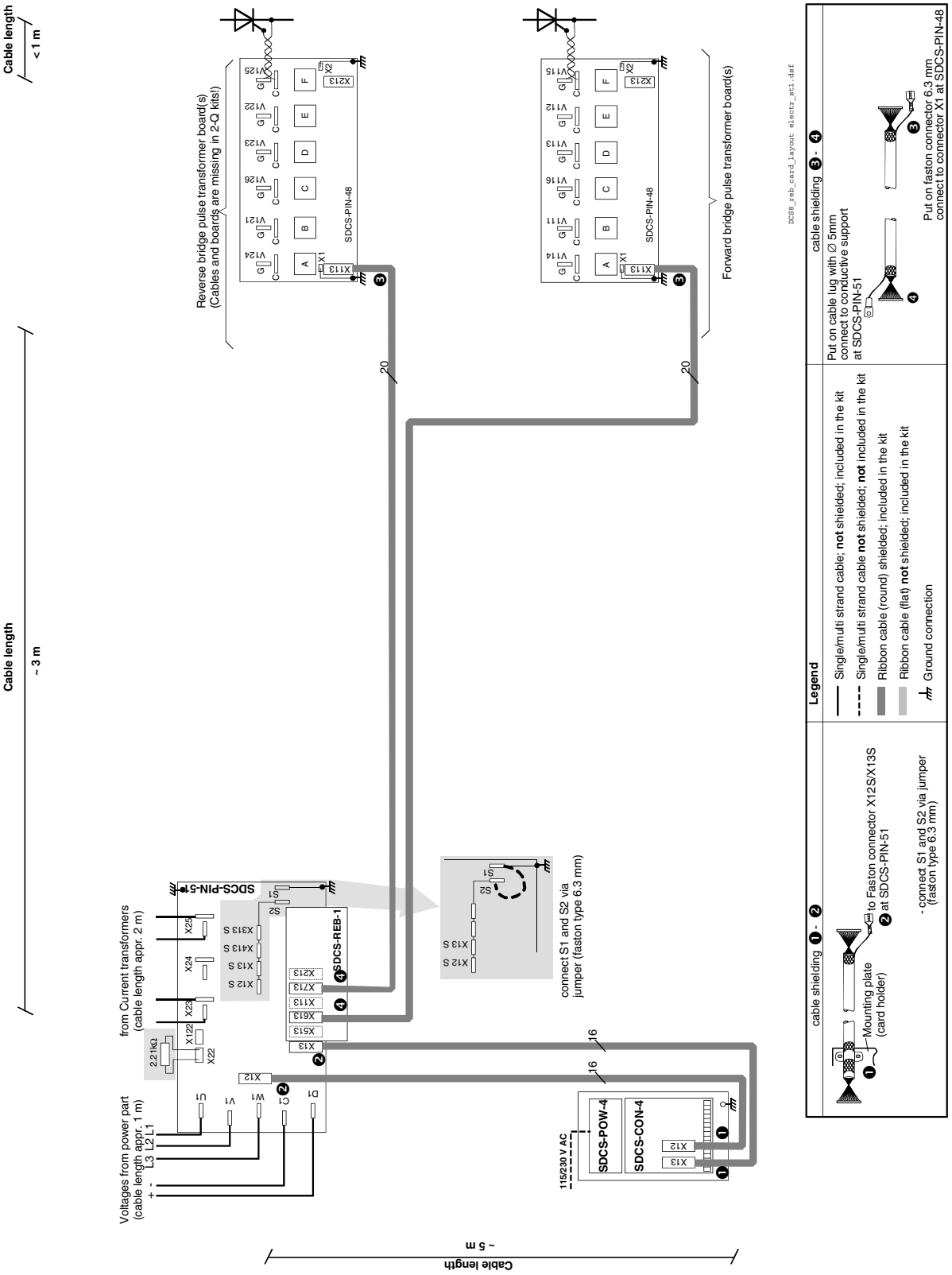


Figure 2: Electrical drawing: 1 thyristor stage

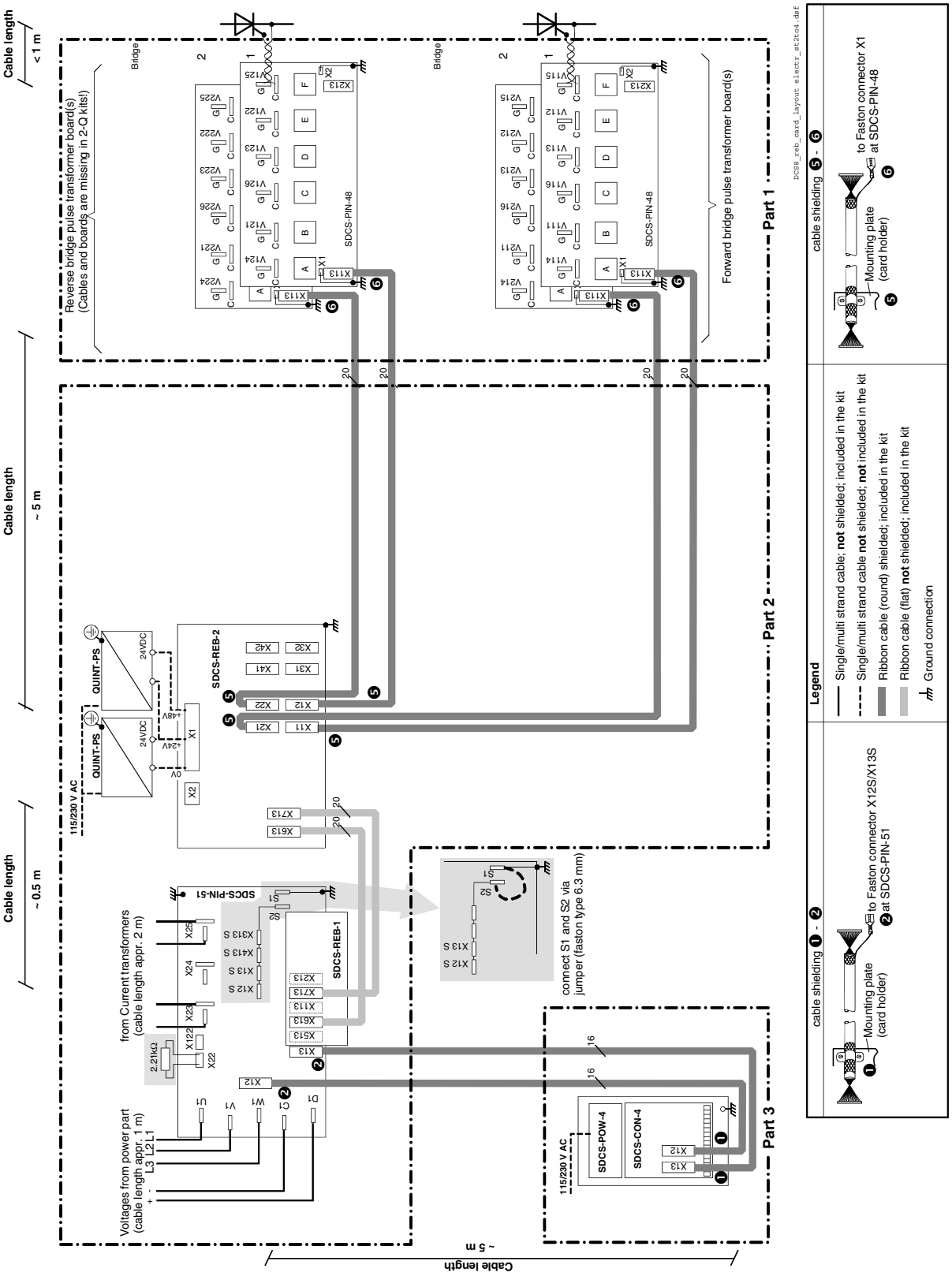


Figure 3: Electrical drawing: 2 Thyristor stages in parallel

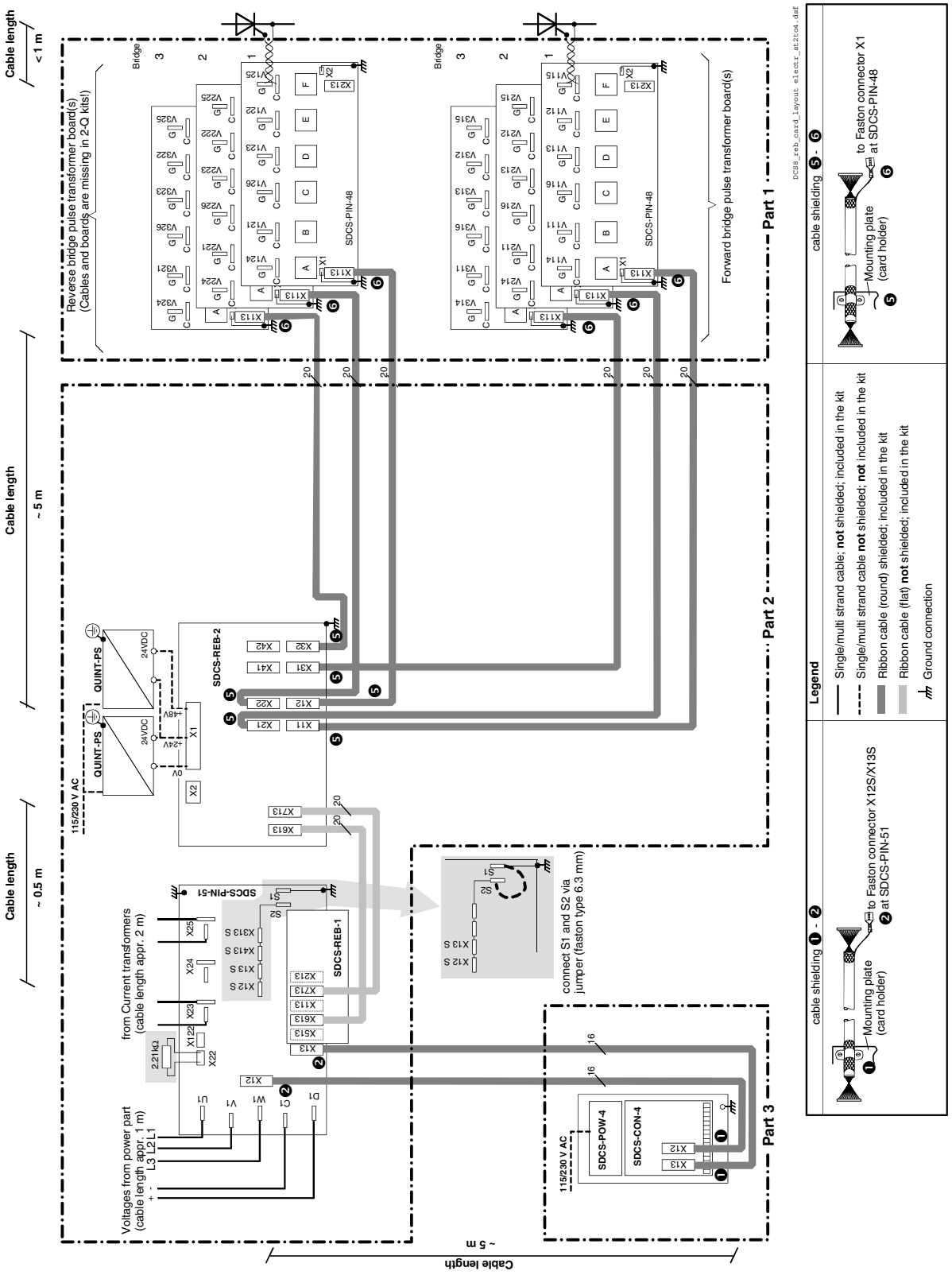


Figure 4: Electrical drawing: 3 Thyristor stages in parallel

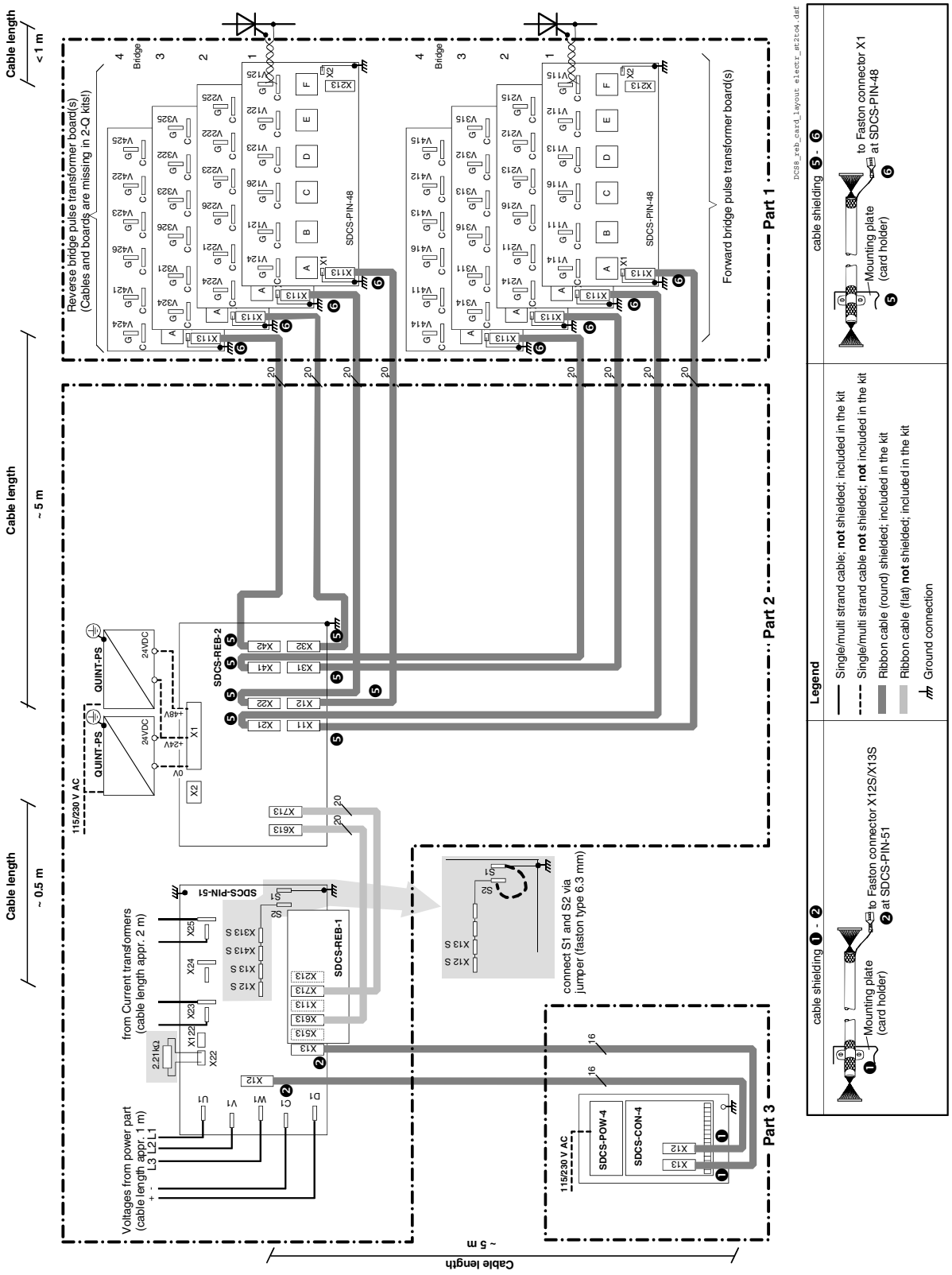


Figure 5: Electrical drawing: 4 Thyristor stages in parallel

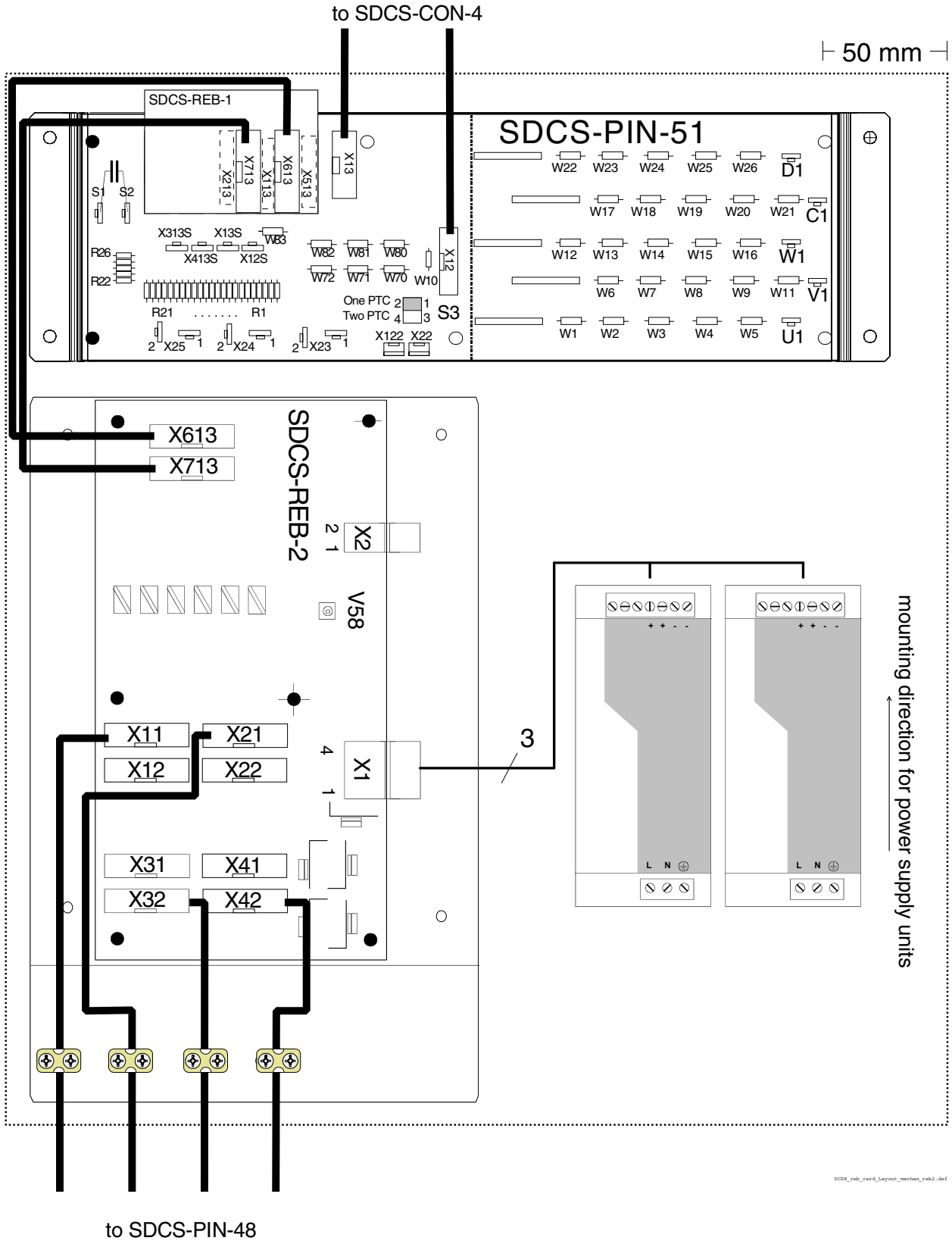


Figure 6: Mechanical suggestion Part 2 without SDCS-REB-3

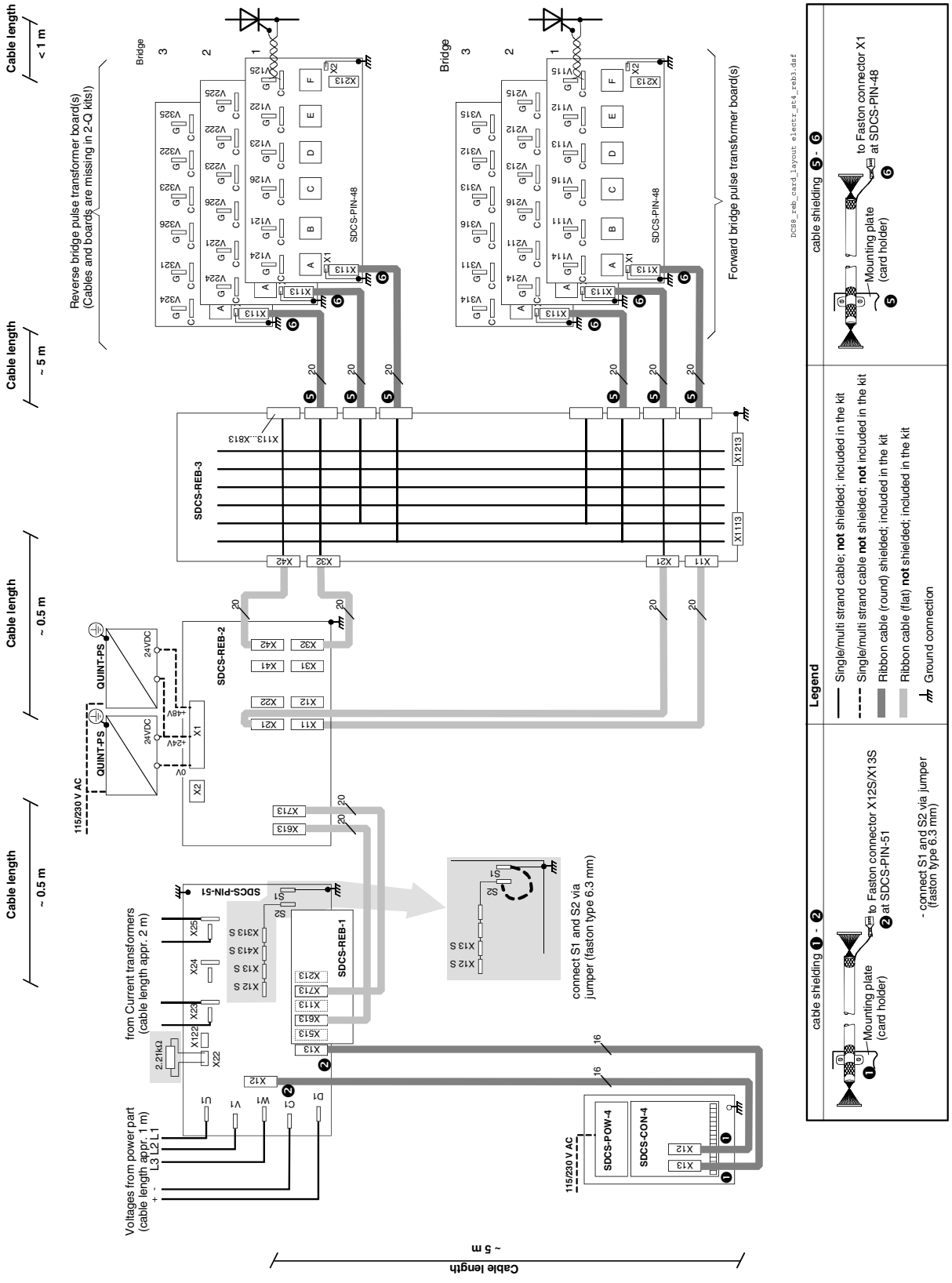


Figure 7: Electr. drawing: 3 Thyr. stages in parallel w. REB-3

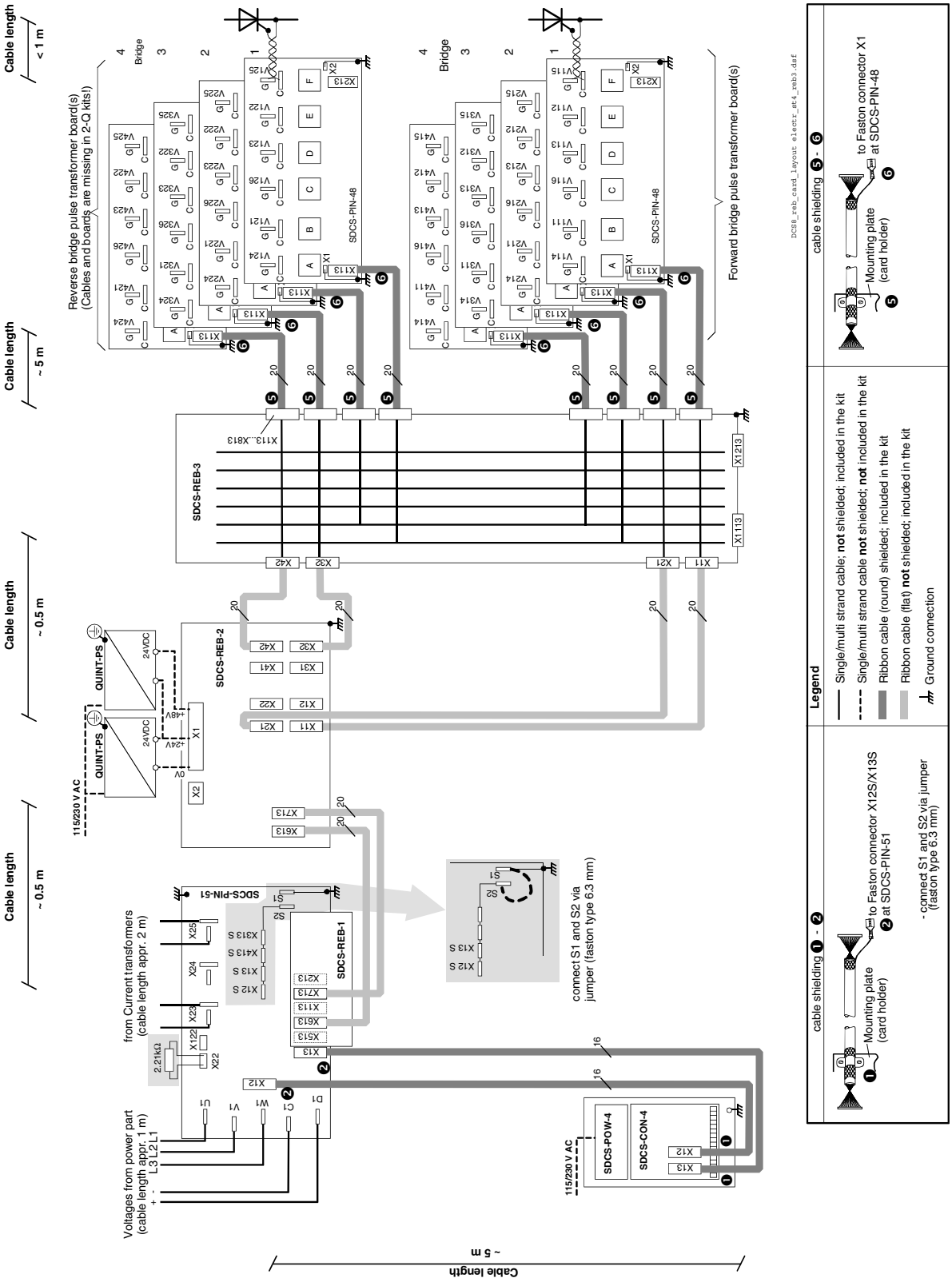


Figure 8: Electr. drawing: 4 Thyr. stages in parallel w. REB-3

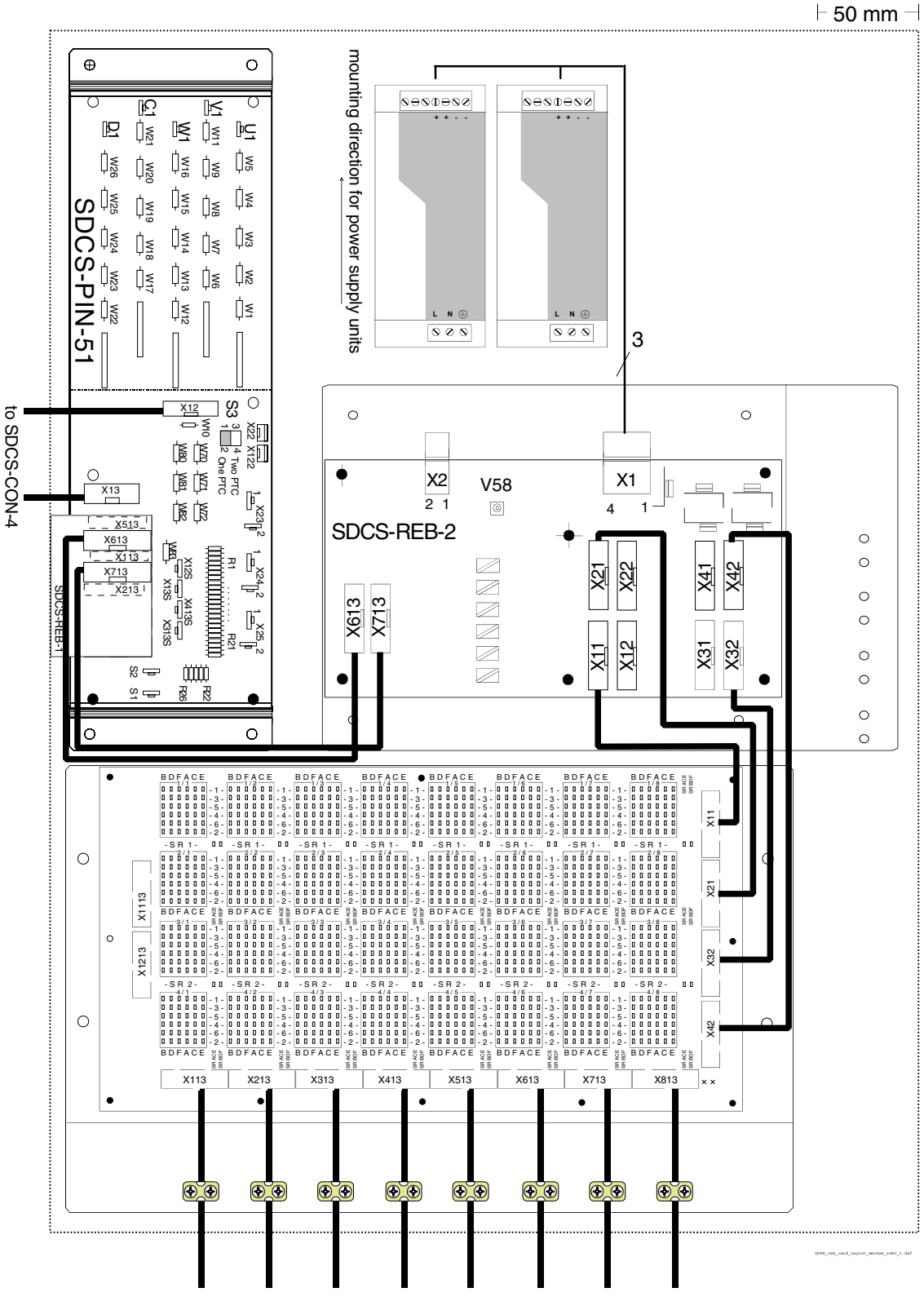


Figure 9: Mechanical suggestion 1 for Part 2 with REB-3

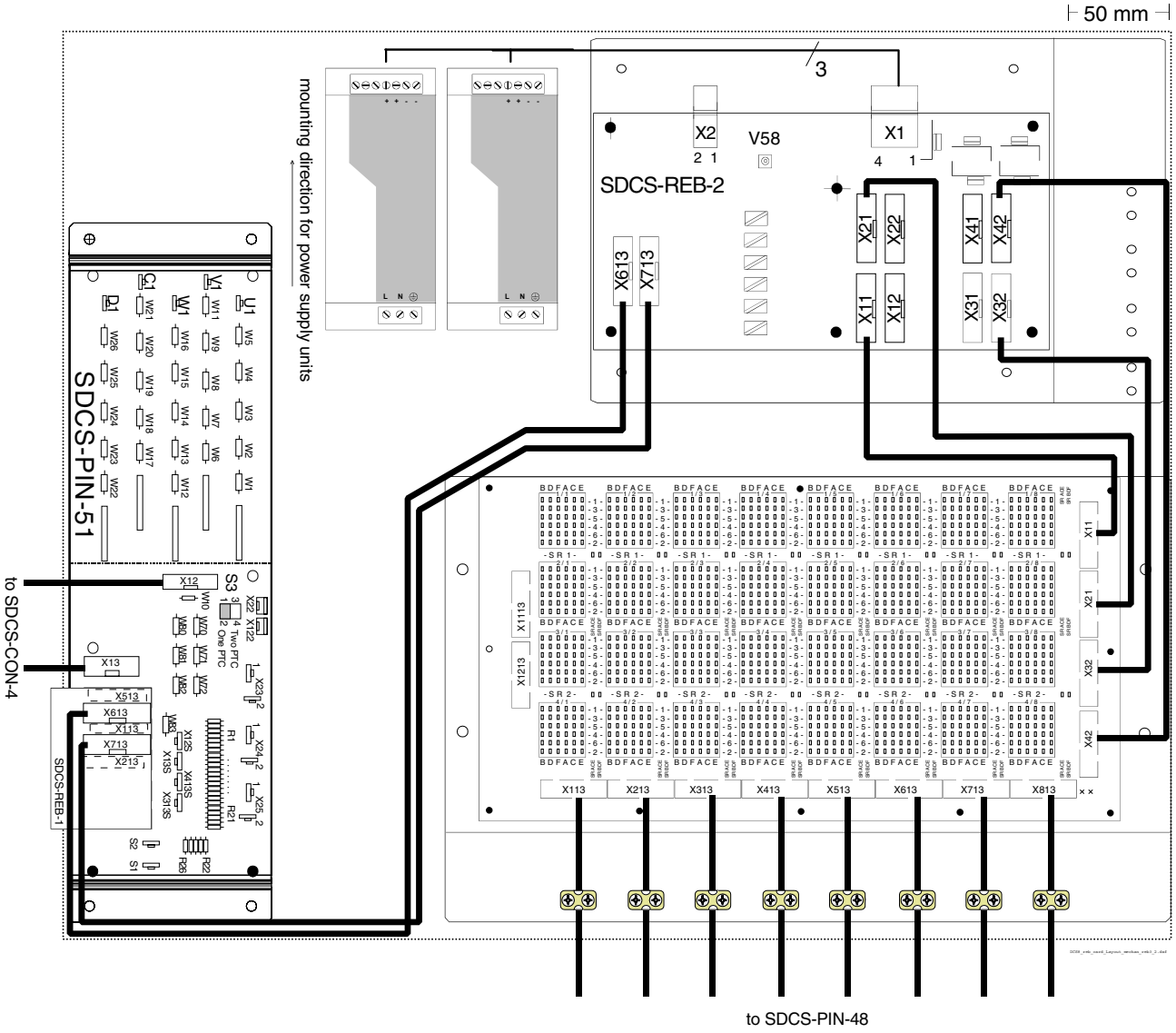


Figure 10: Mechanical suggestion 2 for Part 2 with REB-3

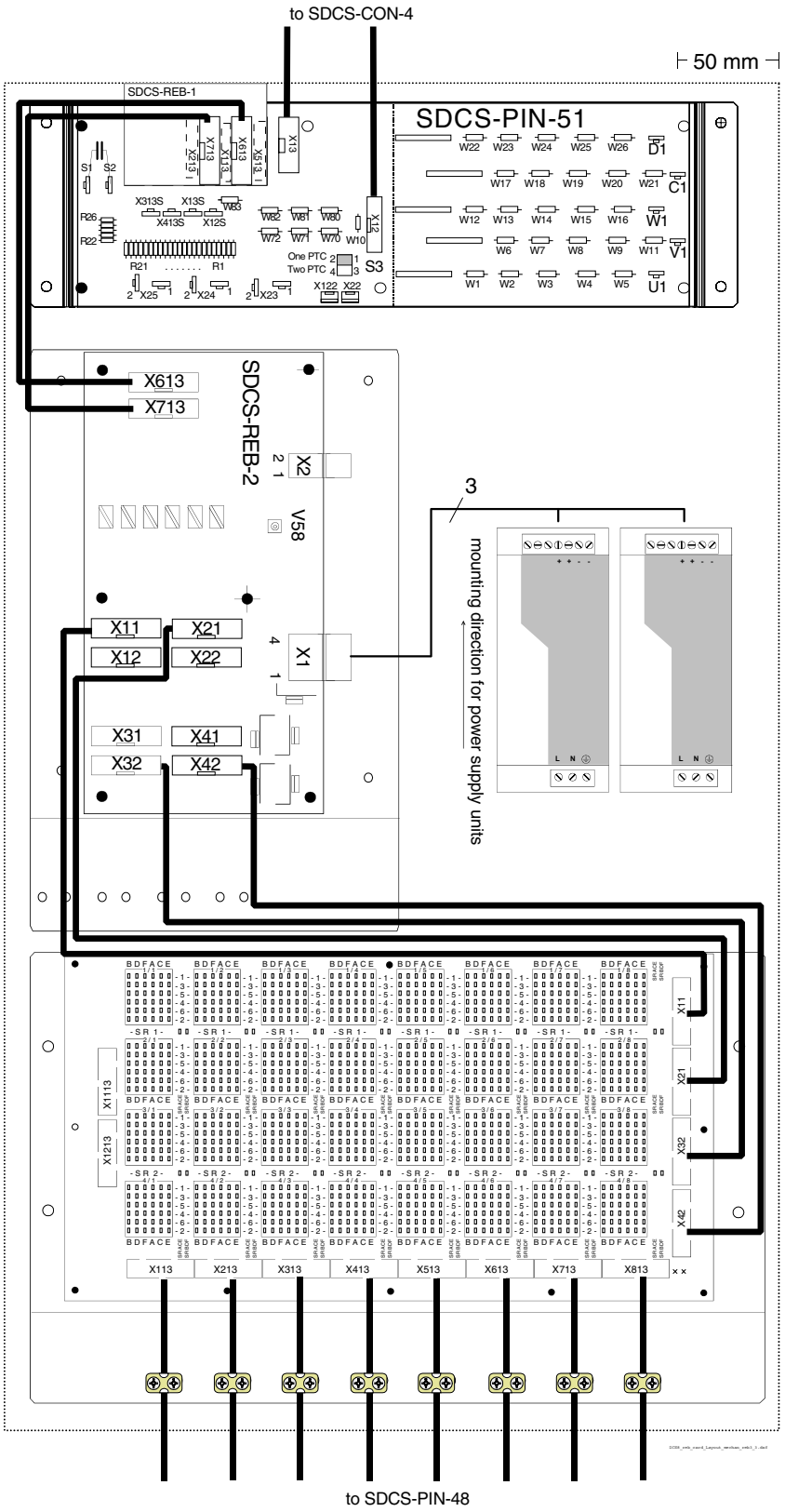


Figure 11: Mechanical suggestion 3 for Part 2 with REB-3

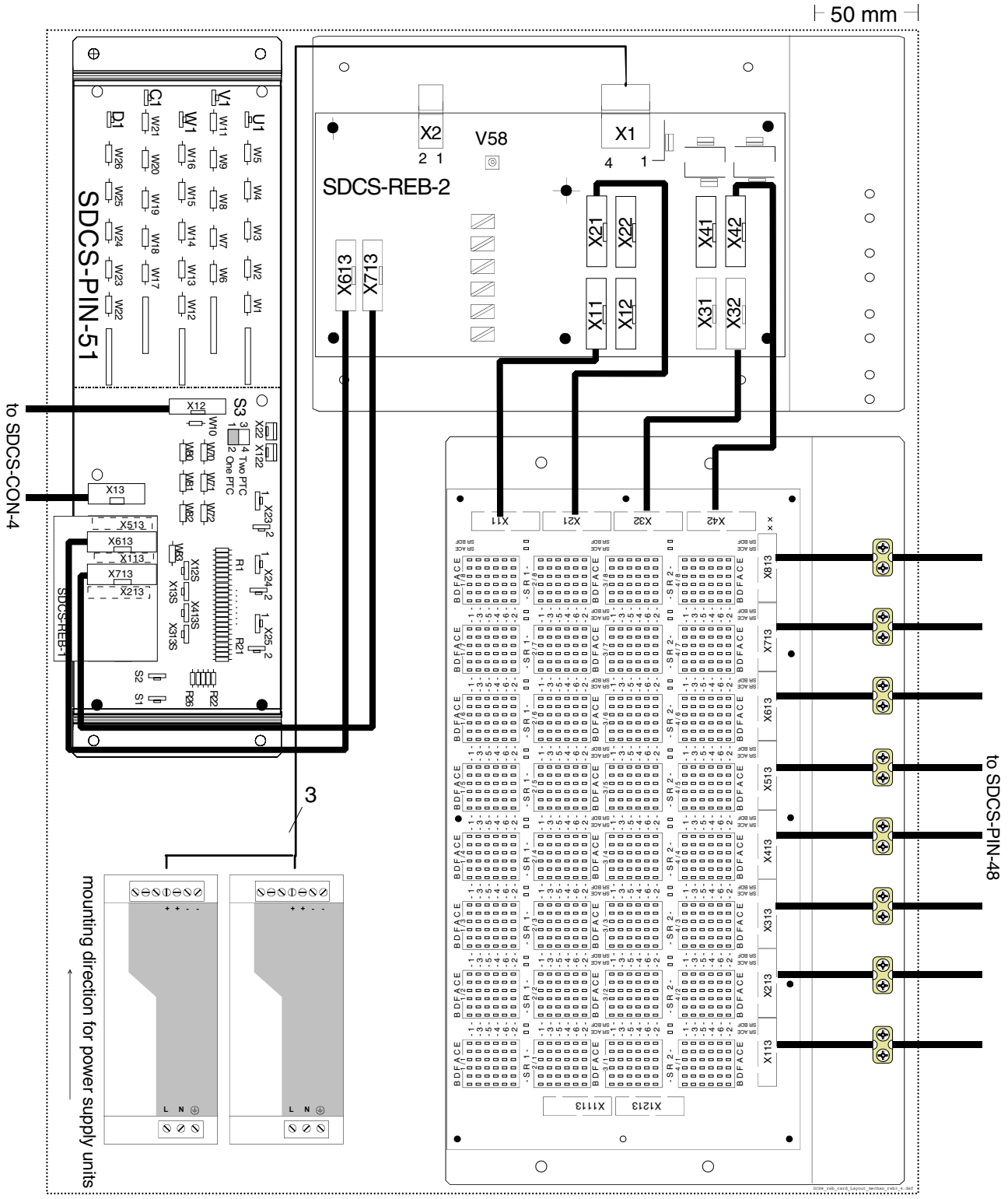


Figure 12: Mechanical suggestion 4 for Part 2 with REB-3

Hints for Cabling

Each kit will be delivered already with most of the cables needed to do the complete wiring. The next table lists the flat cables. Together with Figure 13 they can be identified to use the right cable for any of the connections. In case there is more than one connection between two or more boards (e.g. connection made by cable B2) all the cables will have the same marking.

Marking at Figure 13	*Order number*	*Remark*
A	3ADT 693567R1	2 cables per kit; 5 m long
B1	3ADT 693230R1	1...2 cables per bridge; 3 m long
B2	3ADT 693217R1	2...8 cables per kit; 5 m long
C	GNT 6093268R6	2 cables per kit; 0.5 m long
D	DCA 0020531P1	1x Resistor 2.21 kΩ
E		cable type: AWG20, UL10203,T
F	DCA 0021154R0001	Adapters for different gate connections

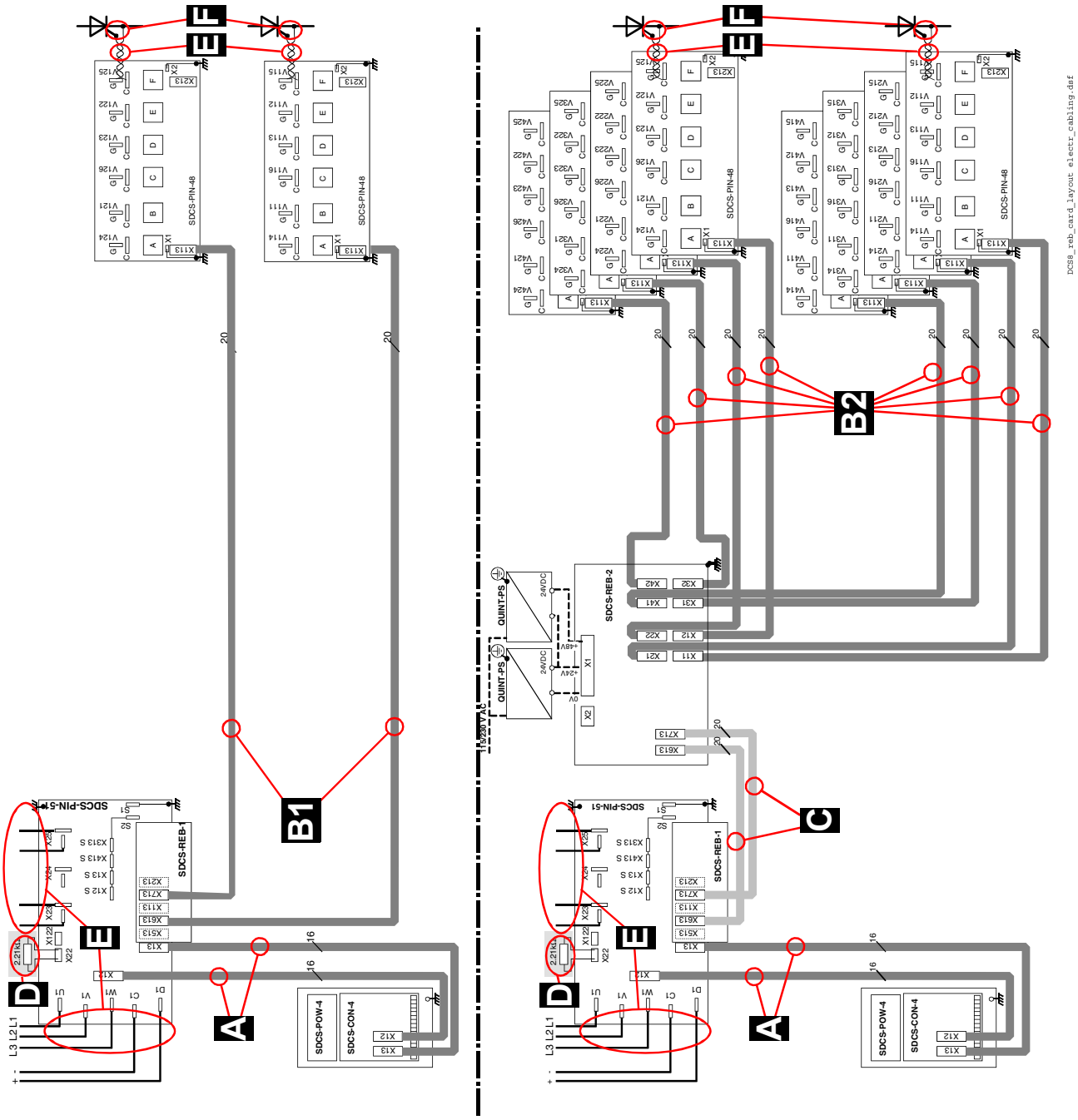


Figure 13: Principles of cabling

Safety Instructions

What this chapter contains

This chapter contains the safety instructions which you must follow when installing, operating and servicing the drive. If ignored, physical injury or death may follow, or damage may occur to the drive, the motor or driven equipment. Read the safety instructions before you work on the unit.

To which products this chapter applies

This chapter applies to the whole range of the product DCS800, the converter modules DCS800-S0x size D1 to D7, field exciter units DCF80x, etc. like the re-build kit DCS800-R0x.

Use of warnings and notes

There are two types of safety instructions throughout this manual: warnings and notes. Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment. They also tell you how to avoid the danger. Notes draw attention to a particular condition or fact, or give information on a subject. The warning symbols are used as follows:

	Dangerous voltage warning warns of high voltage which can cause physical injury and/or damage to the equipment.
	General warning warns about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the equipment.
	Electrostatic discharge warning warns of electrostatic discharge which can damage the equipment.

Installation and maintenance work

These warnings are intended for all who work on the drive, motor cable or motor. Ignoring the instructions can cause physical injury or death.

Only qualified electricians are allowed to install and maintain the drive.

- Never work on the drive, motor cable or motor when main power is applied.
  Always ensure by measuring with a multimeter (impedance at least 1 Mohm) that:
  1. Voltage between drive input phases U1, V1 and W1 and the frame is close to 0 V.
  2. Voltage between terminals C+ and D- and the frame is close to 0 V.
- Do not work on the control cables when power is applied to the drive or to the external control circuits. Externally supplied control circuits may cause dangerous voltages inside the drive even when the main power on the drive is switched off.
- Do not make any insulation or voltage withstand tests on the drive or drive modules.
- When reconnecting the motor cable, always check that the C+ and D- cables are connected with the proper terminal.

Note:

- The motor cable terminals on the drive are at a dangerously high voltage when the input power is on, regardless of whether the motor is running or not.
- Depending on the external wiring, dangerous voltages (115 V, 220 V or 230 V) may be present on the terminals of relay outputs SDCS-IOB-2 and RDIO.
- DCS800 with enclosure extension: Before working on the drive, isolate the whole drive from the supply.

WARNING! The printed circuit boards contain components sensitive to electrostatic discharge. Wear a grounding wrist band when handling the boards. Do not touch the boards unnecessarily.

Use grounding strip:

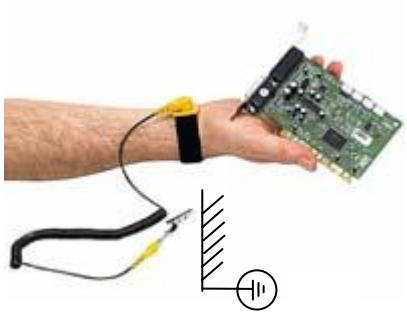


ABB order no.: 3ADV050035P0001

Grounding

These instructions are intended for all who are responsible for the grounding of the drive. Incorrect grounding can cause physical injury, death or equipment malfunction and increase electromagnetic interference

- Ground the drive, motor and adjoining equipment to ensure personnel safety in all circumstances, and to reduce electromagnetic emission and pick-up.
- Make sure that grounding conductors are adequately sized as required by safety regulations.
- In a multiple-drive installation, connect each drive separately to protective earth (PE) ⏚.
- Minimize EMC emission and make a 360° high frequency grounding of screened cable entries at the cabinet lead-through.
- Do not install a drive with EMC filter on an ungrounded power system or a high resistance-grounded (over 30 ohms) power system.

Note:

- Power cable shields are suitable for equipment grounding conductors only when adequately sized to meet safety regulations.
- As the normal leakage current of the drive is higher than 3.5 mA AC or 10 mA DC (stated by EN 50178, 5.2.11.1), a fixed protective earth connection is required.

Fiber optic cables

WARNING! Handle the fiber optic cables with care. When unplugging optic cables, always grab the connector, not the cable itself. Do not touch the ends of the fibers with bare hands as the fiber is extremely sensitive to dirt. The minimum allowed bend radius is 35 mm (1.4 in.).

Mechanical installation

These notes are intended for all who install the drive. Handle the unit carefully to avoid damage and injury.

- DCS800 sizes D4...D7: The drive is heavy. Do not lift it alone. Do not lift the unit by the front cover. Place units D4 and D5 only on its back.

  DCS800 sizes D5...D7: The drive is heavy. Lift the drive by the lifting lugs only. Do not tilt the unit. The unit will overturn from a tilt of about 6 degrees.
- Make sure that dust from drilling does not enter the drive when installing. Electrically conductive dust inside the unit may cause damage or lead to malfunction.
- Ensure sufficient cooling.
- Do not fasten the drive by riveting or welding.

Operation

These warnings are intended for all who plan the operation of the drive or operate the drive. Ignoring the instructions can cause physical injury or death or damage the equipment.

- Before adjusting the drive and putting it into service, make sure that the motor and all driven equipment are suitable for operation throughout the speed range provided by the drive. The drive can be adjusted to operate the motor at speeds above and below the base speed.
- Do not activate automatic fault reset functions of the Standard Application Program if dangerous situations can occur. When activated, these functions will reset the drive and resume operation after a fault.
- Do not control the motor with the disconnecting device (disconnecting mains); instead, use the control panel keys and , or commands via the I/O board of the drive.

- Mains connection
  You can use a disconnect switch (with fuses) in the power supply of the thyristor power converter to disconnect the electrical components of the unit from the power supply for installation and maintenance work. The type of disconnect used must be a disconnect switch as per EN 60947-3, Class B, so as to comply with EU regulations, or a circuit-breaker type which switches off the load circuit by means of an auxiliary contact causing the breaker's main contacts to open. The mains disconnect must be locked in its "OPEN" position during any installation and maintenance work.
- EMERGENCY STOP buttons must be installed at each control desk and at all other control panels requiring an emergency stop function. Pressing the STOP button on the control panel of the thyristor power converter will neither cause an emergency motor stop, nor will the drive be disconnected from any dangerous potential. To avoid unintentional operating states, or to shut the unit down in case of any imminent danger according to the standards in the safety instructions it is not sufficient to merely shut down the drive via signals "RUN", "drive OFF" or "Emergency Stop" respectively "control panel" or "PC tool".
- Intended use
  The operating instructions cannot take into consideration every possible case of configuration, operation or maintenance. Thus, they mainly give such advice only, which is required by qualified personnel for normal operation of the machines and devices in industrial installations.

  If in special cases the electrical machines and devices are intended for use in non-industrial installations - which may require stricter safety regulations (e.g. protection against contact by children or similar) -, these additional safety measures for the installation must be provided by the customer during assembly.

Note:

- When the control location is not set to Local (L not shown in the status row of the display), the stop key on the control panel will not stop the drive. To stop the drive using the control panel, press the LOC/REM key and then the stop key .

Start-up

What this chapter contains

This chapter describes the commissioning procedure for a DCR kit. This is done based on the procedure used for DCS800-S0x converters. Only the actions and steps, which are different, are listed here.

Safety Instructions

The rebuilt kit together with the power part and other components being reused will form a converter and a drive system very similar as a new converter module or a new cubicle with a converter module built-in. Based on that the mechanical and electrical danger installation and commissioning personal is exposed to during the work is similar, sometimes even higher. There is some work, which will only become necessary together with a rebuild kit like thyristor assignment, activation of feedback signals and some tests and measurements not necessary to ready made converters.

Because of that the **Safety Instructions** which have been given within the chapter before **need to be observed with extreme care**!

When listing the different steps of the start-up procedure additional warnings will be given. Based on the possible variations caused by the individual projects not all conditions can be covered. Please take that procedure as a general guideline and be prepared for individual decisions concerning safety and security.

Points to be observed because of the situation

All relevant safety regulations must be observed in the installation, commissioning and maintenance work.

Because the rebuild kit enclosure class is IP00, it´s main and auxiliary connections and other electrical parts can be reached without any protection.

After the supply voltage is disconnected by the main switch, always ensure by measuring that no part of the system has voltage or the system is protected with sufficient touching cover before any work is started.

There might be live terminals inside the drive cabinet even after the supply voltage has been disconnected by the any main switch, e.g. incoming busbars of the main switch itself or external auxiliary power supplies.

Avoid unnecessary voltage withstand tests on any part of the unit.

Maintenance work

All maintenance must be carried out by a competent electrician, who shall also have custody of keys to the doors, unless the system is located in switch gear.

All points within this chapter must be observed before any work is begun.

Tools

In addition to the tools needed to maintain electrical parts some special tools are recommended:

- Oscilloscope either with galvanically isolating transformer or isolating amplifier for safe measurements
- Clamp on current probe; an AC type is sufficient for gate firing pulse measurements; in case the scaling of the DC load current needs to be checked, a DC type is needed
- Voltmeter

Make sure, all equipment in use is suitable for that voltage level applied to the power part!

General hint

In addition to the work specific for the installation of the pure rebuild kit hardware attention should be paid to features related to drives in general. There is the engineering and the interface to other components in general, the selection of control cables and their routing, earthing and grounding, screening and other points which need further considerations. The manual *Technical Guide* gives some help within the chapter *EMC Compliant Installation and Configuration for a Power Drive System*. This chapter gives information specific to fulfill the needs necessary for the CE marking. Most often CE marking is not the most important target for a system upgraded by a rebuild kit. Nevertheless using some of the ideas will make the complete system safer.

Measurements with the “old” equipment still working

Some measurements should be carried out before the existing installation is switched off and dismantled. They serve to document the existing performance and get the definition of some signals or terminals of the existing hardware:

- record the actual signals of
  - the speed
  - the armature and the field current
  - line, armature and field voltage
  - other application related signals
  - record line and armature voltage to determine the name of the single line phase and the position of the + and – terminal; this will be an alternative to disassemble the thyristor stack to check the orientation of the thyristors
  - at power parts with more than one thyristor in parallel, record the firing pulse and the thyristor current of each thyristor to be sure, all of them are conducting

Mounting the Kit

When starting the installation work make sure the equipment is disconnected from the power supply and checked for safe condition! The figures within chapter *Installation* show all the components needed for the different configurations possible. Use this drawing as a basic guideline which fits the best to the actual power part depending on the number of parallel thyristors and the configuration (with / without SDCS-REB-3). Mounting the boards can be subdivided into 3 steps:

- Select a place for the SDCS-PIN-48 board(s) as close as possible beside the thyristors. When fixing the board at the selected place make sure it´s conductive supports / card holder have good metal contact to the cubicle´s frame. This frame by itself has to be grounded.
- Select a place for the SDCS-PIN-51 (and all the other components shown within “part 2“). Take care for the cable length towards the SDCS-PIN-48 board(s) and towards the SDCS-CON-4 board. All components of this part 2 have to be mounted on a metal plate to ensure good contact between conductive supports / card holder and the cubicle´s frame. This frame by itself has to be grounded. Make sure the shields of the shielded cables follow the guidelines given in chapter *Installation* (grounding on large areas by means of clamps).
- Select a place for the electronics housing and mount it. Take care for the cable length towards the SDCS-PIN-51. Take the same grounding guidelines as before.

Wiring the Kit

The system still has to be in a safe condition! The drawing used for the mechanical work should now be used for the electrical wiring too. For single thyristor bridges take the hints given in chapter *Interfacing the Electronics and Thyristors* into consideration. Before the wiring work is started do the following preparations:

- Check, if there are labels / indications on the existing power part naming the thyristors and / or phases according to figure *Arrangement of thyristors in an anti parallel bridge*. In case labels are existing, check, if they are correct and fit to each other.
- If there are no labels existing or they are incorrect, start in this way:
  - look for the phase U1 (L1) and mark it; do the same with V1 (L2) and W1 (L3)
  - look for thyristor V11 and mark it; the next statements may be of help in case problems may arise
    - use the measurements done before
    - if not, follow the busbar U1; the thyristor connected to that busbar is either V11 or V24
    - the cathode of V11 (or the heatsink) has electrical contact to the C1 / + power part terminal
    - at disk type thyristors the orientation can easily be recognised by the smaller distance between cathode and gate compared to the bigger distance between gate and anode
    - if the place of V11/V24 is found, but the orientation is not clear and the thyristor is not visible take one pair of pulse firing leads (one of them is

the auxiliary cathode) and check them for electrical contact to C1 / + power part terminal by means of an Ω-meter
  - look for the other thyristors and mark them
  - if there are parallel connected thyristor bridges do the same marking as for the first
- do the electrical connections according to the drawing for:
  - all the flat cable connections within and between the 3 parts
  - the 3 AC and the 2 DC voltage measurements
  - the 2 current transformers
  - for the power part monitoring (klixon, fan monitoring, others)
  - the auxiliary voltage
  - make sure a 2.2 kohm resistor or something similar is plugged on terminal X22: at SDCS-PIN-51 board
  - make sure the jumper is placed on S1 and S2 on the SDCS-PIN-51 board
  - make sure all cable shields are correctly connected
  - **don´t connect any of the gate leads!**

Commissioning the Kit

The complete commissioning of a DC drive consisting of the motor and the thyristorized power part equipped with a rebuild kit is based on the manuals used for the converter type DCS800-S0x. Only a few additional steps are recommended and will be listed afterwards.

Start with the commissioning steps used for complete converter modules:

- Safety Instructions, local safety regulations, etc.
- Check the engineering, e.g. make sure the selected voltage levels are correct and selector switches (if existing) are in the correct position.
- Make sure safety equipment is working properly.
- Set basic parameters, e.g. the ones which are presetted by the WIZARD within the PC-based tool DriveWindow Light during steps 1 and 2.
- Set the parameters in group 97 described in chapter *Hardware* section *Measurement board SDCS-PIN-51*

For setting the values of parameters 97.01 to 97.03 the following procedure needs to be used:

- Select 99.06 and set to **SetTypeCode** (equivalent value **10**)
- Select 97.01 and make sure it's set to **None** (equivalent value **0**)
- Select 97.02 and set the value demanded by the hardware
- Select 97.03 and set the value demanded by the hardware
- Select 97.04 and 97.07 and set as recommended/necessity
- Switch OFF the control voltage of the rebuild kit and ON again to apply the settings!

In contrast with the normal commissioning procedure additional precautions should be made to avoid damage to components of the drive system in case of wrong wiring or unknown data.

- Connect the gate leads to thyristor V11, V13 and V15.
- Set the parameter for the bridge changeover to a remarkable value.
- Before the drive is released the first time, the parameter for the minimum firing

angle should be set to values higher than 95 degrees. Allow the system some moments to adapt to the new value. This limits the output voltage of the drive and gives a safe operation, even with a fault in the current feedback circuit. Precautions should be made do avoid to get EMF at the DC circuit (disable field current or block the motor), if the drive will be released and will generate current.

- Switch on the drive using the ON/OFF command. The RUN command has to remain in logic “0” level. This action causes the pulse firing logic to work and to generate single firing pulses at inverter limit position. No current should flow. Record the thyristor voltage (connection U1 – C1) and the firing pulse (e.g. by means of a current probe) and check the firing pulse position being at 150°el.
- Switch off the drive.
- Connect the gate leads to thyristor V14, 16 and 12.
- Switch on the drive using the ON/OFF command.
- No current should flow! Record the thyristor voltage and the firing pulse as before.
- Switch off the drive.
- Switch on the drive using the ON/OFF command. Set the RUN command to logic “1” level. Generate small current references within zero and limit discontinuous / continuous current. Everything is o.k., if the current can be varied and does not hit the limit set by the parameter above or inverter limit position. Depending on the value of the minimum firing angle (perhaps higher than $120°_{el}$, perhaps close to $150°_{el}$) it may happen, that there is either no current at all or a very small one. In this case change the settings step by step until a value around $100°_{el}$ reached.
- Switch off the drive.
- In case of trouble check the wiring for open loop or wrong connections. Do the check once again.
- In case the current can be varied by the reference and the power part consists of a reverse bridge go on with the same procedure used for the forward bridge. Keep the value of the parameter for minimum firing angle position. Check for correct connections.

If current is flowing in forward and reverse direction in a controlled manner set the parameter for the minimum firing angle back to default. Check for the correct value for the parameter of the bridge changeover time.

In case the power part consists of parallel bridges do the gate interconnections bridge per bridge and check for correct assignment. Do the commissioning of the other parallel bridges once again with the minimum firing angle set to high values because of safety reasons.

When the gate connections are done and current is flowing in a controlled manner set the minimum firing angle position to default, the bridge changeover time to values necessary and go on with the other steps necessary to get the drive into operation.

DCS800 family

DCS800-S modules

The versatile drive for any application

20 … 5,200 A_{DC}
0 … 1,160 V_{DC}
230 … 1,000 V_{AC}
IP00

- Compact
- Highest power ability
- Simple operation
- Comfortable assistants, e.g. for commissioning or fault tracing
- Scalable to all applications
- Free programmable by means of integrated IEC61131-PLC

DCS800-A enclosed converters

Complete drive solutions

20 … 20,000 A_{DC}
0 … 1,500 V_{DC}
230 … 1,200 V_{AC}
IP21 – IP54

- Individually adaptable to customer requirements
- User-defined accessories like external PLC or automation systems can be included
- High power solutions in 6- and 12-pulse up to 20,000 A, 1,500 V
- In accordance to usual standards
- Individually factory load tested
- Detailed documentation

DCS800-E series

Pre-assembled drive-kits

20 … 2,000 A_{DC}
0 … 700 V_{DC}
230 … 600 V_{AC}
IP00

- DCS800 module with all necessary accessories mounted and fully cabled on a panel
- Very fast installation and commissioning
- Squeezes shut-down-times in revamp projects to a minimum
- Fits into Rittal cabinets
- Compact version up to 450 A and Vario version up to 2,000 A

DCS800-R Rebuild Kit

Digital control-kit for existing powerstacks

20 … 20,000 A_{DC}
0 … 1,160 V_{DC}
230 … 1,200 V_{AC}
IP00

- Proven long life components are re-used, such as power stacks, (main) contactors, cabinets and cabling / busbars, cooling systems
- Use of up-to-date communication facilities
- Increase of production and quality
- Very cost-effective solution
- Open Rebuild Kits for nearly all existing DC drives
- tailor-made solutions for…
  - BBC PxD
  - BBC SZxD
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ABB Automation Products GmbH
Wallstadter Straße 59
68526 Ladenburg • GERMANY
Tel: +49 (0) 6203-71 0
Fax:+49 (0) 6203-71 7609
www.abb.com/motors&drives

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